



CMOM PROGRAM MANUAL

Town of Hull WPCF

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COMMITMENT & INTEGRITY DRIVE RESULTS

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EXECUTIVE SUMMARY

The Town of Hull (Town) is a peninsula community of about 10,000 permanent residents, and 15,000 seasonal residents, located between Hingham Bay and Massachusetts Bay on the South Shore of Massachusetts. The Town's sewer system is comprised of approximately 42 miles of separated gravity sewers, seven sanitary wastewater pumping stations, and over 175 publicly-owned grinder pumps within the low-pressure sewer system, which send flow to the Town's Water Pollution Control Facility (WPCF). The WPCF discharges treated effluent to Massachusetts Bay, regulated under a National Pollutant Discharge Elimination System (NPDES) permit. The WPCF also receives flow from the neighboring towns of Cohasset and Hingham, through a sewer utility Inter-Municipal Agreement (IMA).

Due to Town's unique geography, the collection system resembles a "fish skeleton" instead of a typical "tree" configuration. The back bone of the system is the interceptor, which ranges in size from 30" to 36" and is constructed of reinforced concrete. The main gravity interceptor was installed in late 1970's, and 42% of the interceptor has been rehabilitated with a cured-in-place liner. Most areas of the collection system consist of vitrified clay and asbestos cement pipe, with some older areas of original brick infrastructure (late 1800's) and newer areas of PVC (installed in the 1980's and 90's).

On May 1, 2015, Woodard & Curran (W&C) entered a 10-year contract to operate and maintain the treatment and collection system for the Town Sewer Department. As part of ongoing contract operations work, W&C has prepared several versions of recommended capital repairs and improvements to the collection system and pump stations, as well as treatment plant equipment and unit process upgrade recommendations. See Appendix A for the Annual Operating Report for Contract Years 1 and 2.

One year after starting operations, on May 1, 2016, the Town entered an Administrative Order on Consent (AOC) with U.S. Environmental Protection Agency (EPA) and MassDEP to address ongoing critical asset repairs and address Sanitary Sewer Overflows (SSO's) within the collection system. The AOC (Docket No. CWA-01-AO-16-09) requires several immediate deliverables, including a Collection Management, Operation and Maintenance (CMOM) Program Manual and Action Plan for the collection system and WPCF. The following deliverables have been submitted in compliance with the AOC timeline:

1. Unauthorized Discharge Summary, delivered July 31, 2016
2. Emergency Response Plan, delivered August 31, 2016
3. I/I Report, delivered August 31, 2016
4. CMOM Self-Assessment, delivered October 31, 2016
5. Implementation Annual Report, delivered March 31, 2016 (due consecutively, every March 31)

On February 14, 2017, the Town retained Woodard & Curran (W&C) to execute a Change Order to the Operations and Maintenance contract to provide engineering and support services. The key purpose of this change order was to develop an innovative plan for providing overall engineering and O&M support for many interrelated wastewater utility asset management needs. The following AOC deliverables remain:

6. Program Manual – This Document
7. CMOM Corrective Action Plan, due July 31, 2017
8. Third-Year CMOM Program Assessment Checklist, due July 31, 2019

In addition to the Administrative Order on Consent deliverables, the Town of Hull recently delivered a Draft Asset Management Plan (see Appendix B) to MassDEP in fulfillment of the Asset Management and Fiscal Sustainability Planning Grant Program. This document and several of the programs outlined, including a Funding Plan Tool, are

being used to assess items of improvement to be included on the Corrective Action Plan, due July 31, 2017 and State Revolving Fund Application, due August 11, 2017.

Outside of regulatory requirements, the Sewer Department is voluntarily participating in the Effective Utility Management (EUM) framework process in order to accommodate their utility's concerns over the next round of capital upgrades including, but not limited to:

- Rising costs
- Aging infrastructure
- A rapidly changing workforce

Based on these challenges, the EUM Collaborating Organizations (EPA and six national water and wastewater associations) created a program to promote effective utility management based on the Ten Attributes of Effectively Managed Water Sector Utilities and five Keys to Management Success. For reference, the attributes and keys are as follows:

Ten Attributes of Effectively Managed Water Sector Utilities:

- | | |
|--|--|
| 1. Product Quality | 6. Employee and Leadership Development |
| 2. Customer Satisfaction | 7. Enterprise Resiliency |
| 3. Stakeholder Understanding and Support | 8. Infrastructure Strategy and Performance |
| 4. Financial Viability | 9. Community Sustainability |
| 5. Operational Optimization | 10. Water Resource Sustainability |

Five Keys to Management Success:

1. Leadership
2. Strategic Business Planning
3. Knowledge Management
4. Measurement
5. Continual Improvement Management

The Town of Hull's participation is on-going, and expected to help guide future capital and operational improvements over time.

1. COLLECTION SYSTEM MANAGEMENT

Town of Hull's 10-year contract to operate and maintain the treatment and collection system for the Town Sewer Department covers the assets we manage in our wastewater collection system and is one component of our overall Capacity, Management, Operations and Maintenance (CMOM) Plan. The Contract outlines required preventive, predictive and corrective maintenance strategies, and includes Woodard & Curran's additions based on our O&M best management practices.

1.1 Organizational Structure

Town of Hull's Sewer Department is under the Department of Public Works and is responsible for all aspects of our wastewater collection system and treatment. In 2015, the Town of Hull contracted operations to Woodard & Curran (W&C). The Sewer Department, in cooperation with the Contract Operator, maintains all publicly owned treatment works (POTW) collection and treatment systems. The Contract Operator has a staff of 6 full time, plus technical support staff, to oversee the wastewater system, both collections and treatment facility operation and maintenance. There are 2 summer interns and other part-time support staff as well. The W&C staff also oversee the operation of the D Street storm water pump station. Contractors are used for some maintenance activities and for emergency support. Figure 1-1 shows the organizational structure of the Sewer Department.

1.2 Training

Training is an important part of any operation to ensure employee health and safety is assured, quality standards are maintained, staff skills are improved, career opportunities become available, and higher productivity is achieved. Safety and technical training are provided to staff regularly in accordance with Contract Operation requirements and MA DEP Operator Certification requirements (both in-house specialty training and external resources are utilized). See Table on page 1-2 for an outline of required training.

1.3 Internal Communication

As a contract operator, the internal communication is supported in person and via daily reporting requirements, per the Contract. Daily, monthly, and annual reporting requirements are included in detail in Section 2.11 and 2.12 of the Contract Operations Agreement.

Table 1-1: Contract Operator Annual Training Requirements for Hull WPCF

Typical Certifications/Training & Role	Project Manager	Asst. Project Manager	Lead O&M Technician	O&M Technician	Technician - Trainee	Technician - Mechanic	Technician - Part Time	Summer Intern
State/Federal Certification								
Mass. Hoisting License (520 CMR)	1C							
Mass. Wastewater Operator's License (257 CMR 2.0)	7	6	6	3			5	
UST Inspection Certification (310 CMR 80.0)								
OSHA Forklift Operation Certification								
On-site Training								
Plant Rounds/Process								
Pump Station Rounds								
H2S Awareness								
Record Keeping (SEMS, doFORMS, Hach WIMS)								
Health and Safety - Site Specific								
Health and Safety - PureSafety® Online Training								
DigSafe Awareness								
Grinder Pump Calls								
On-Call Duties								
Laboratory								
GoPro								
Gold Arrow GPS Unit								
Portable Diesel Pump Operation								
Environmental Compliance Regulations Awareness								
Predictive Maintenance Skills								
SL-RAT								
Specialty Training								
Manhole Sewer Inspections		NASSCO MACP		NASSCO MACP				
Electrical Qualified Worker								
Confined Space								
CPR/First Aid								

TOWN OF HULL, MA | WASTEWATER SYSTEM ORGANIZATION CHART

Woodard & Curran Support Staff

Cara Hanson | HR

207.558.3679 (o) | 207.650.9695 (c)

Jeannie Dubois | IT

860.253.2676 (o) | 860.605.0358 (c)

Alan Fabiano | Technology

914.246.2927 (o) | 914.456.3115 (c)

Steve Rose | SCADA Supportt

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Jody St. George | Sr. O&M Specialist

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Jim Gagliard | Sr. O&M Specialist

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Laura Bonk | Health & Safety

978.452.7889 (o) | 603.340.3524 (c)

Mike Cherniak | Compliance

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Kim Brierley | Billing/Project Assistant

781.613.0087 (o)

Brenda Douglas | Part Time Project Admin.

781.383.0057 (o)

Jackie Smith | Marketing Assistant

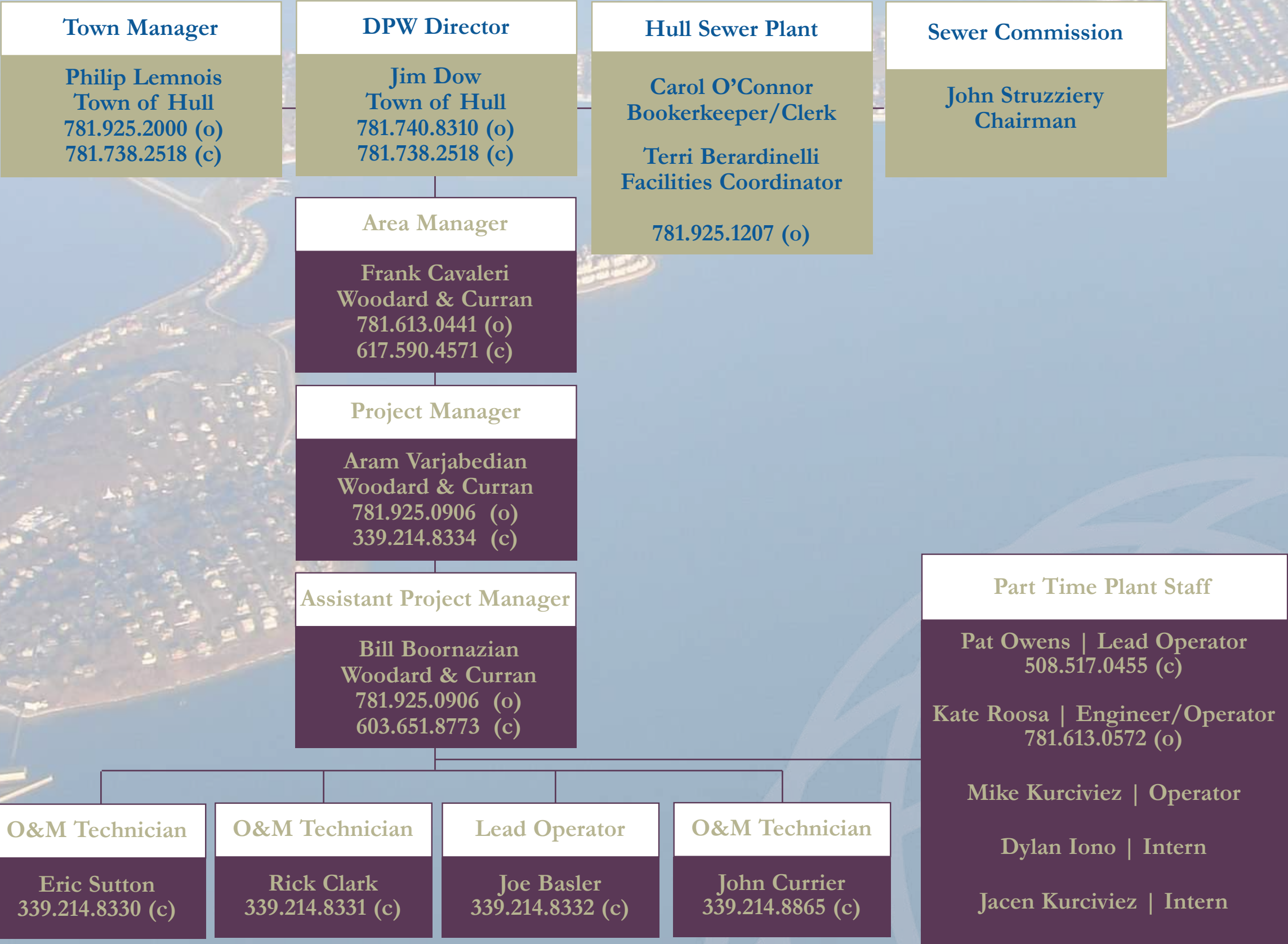
207.558.3726 (o) | 207.749.4990 (c)

Woodard & Curran Engineering Support

• Compliance

• CMOM

• Engineering Support



1.4 Customer Service

Complaint records are maintained through work orders generated in SEMS. When a call is received from the Sewer Department, the WWTF is asked to respond or address the complaint as determined by the Sewer Dept. office.

1.5 Management Information Systems

Collection system information is managed by several database systems including SCADA, CMMS (SEMS Technologies coupled with DoForms), GIS (Utility Cloud©), and Hach WIMS. SCADA provides real time information associated with the pump stations and stores the data for basic trending. This GIS system, Utility Cloud provides a map with associated attribute and condition data. Hach WIMS and the CMMS are used to manage the daily inspection data and maintenance activities for the entire wastewater system. System information managed in our SEMS database includes:

- Routine and Priority Planned maintenance (cleaning, etc.)
- Inspection scheduling and tracking
 - Manhole
 - Pipeline (Closed Circuit Television (CCTV), camera)
 - Pump station
- Work Orders
- Vehicle maintenance
- Complaints
- Customer service response
- Safety Incidents
- Emergency Response
- Compliance/Overflow Tracking

Any activity performed by Contract Operator personnel is generated and tracked through DoForms. DoForms produces work orders for the performance of routine maintenance as well as repairs and corrective actions in response to inspections and customer complaints. Upon completion of the tasks, data is uploaded and saved for reporting performance and historical information on the collection system (including Pump Stations) as well as the WPCF. See Appendix H for some sample work order forms and reports.

1.6 Unauthorized Discharge Notification Systems

In the event of an unauthorized discharge, an email or telephone call is to be made within 24-hours of discovering the release and the written report is to be submitted within 5 days. For Town of Hull WPCF, the Project Manager provides notice via email (and telephone call, if necessary) to the following department liaisons:

- MassDEP: Water Resources Contacts-Sewers-Combined Sewer Overflows-Southeast Region Agent
- EPA: Region 1 Contact
- Hull Board of Health: Public Health Director
- Hull Public Works: Department of Public Works Director or Asst. Director

If a release has directly impacted nearby waterbodies or wetland resources, then the following parties are to be notified based on discharge scope and Project Manager discretion:

- Massachusetts Division of Marine Fisheries
- Town of Hull Harbormaster/Shellfish Warden
- Town of Hull Conservation Agent

For additional information, please refer to the Emergency Response Plan, as submitted on August 31, 2016.

1.7 Legal Authorities and Controls

The Town of Hull has established and implemented regulations regarding the use of the wastewater collection system. The Town of Hull has a comprehensive sewer use ordinance, consistent with EPA's model ordinance, in place since 1987. As regulations and requirements have changed, the Town has passed additional ordinances to address those issues. Ordinances are kept up-to-date and are available electronically at http://www.town.hull.ma.us/Public_Documents/HullMA_Sewer/homepage.

The items addressed through our sewer ordinances include: FOG, Building Structures over Sewer Lines, Stormwater Connections, Service Lateral Defects, Sump Pumps, Grinder Pumps, and Illegal Connections. The Town of Hull also has Inter-Municipal Agreements (IMAs) with the Towns of Cohasset and Hingham, to convey wastewater to the Hull WPCF.

2. COLLECTION SYSTEM OPERATION

Prior to 1978, 14 miles of combined sewer existed. These combined sewers were separated during Phase 1 and II construction in the early 1980's. After the installation of the WPCF, the remaining 25+ miles of gravity sewer were installed throughout the Town of Hull peninsula. Today, Hull has 4,809 service connections; including 4,497 from Hull and 312 from Hingham and Cohasset. There are approximately 994 manholes and 210,000 linear feet (40 miles) of gravity sewer (ranging in diameter from 4" to 36"). About 20,000 feet of low pressure sewer serve 175 homes with Town owned grinder pumps, with approximately an additional 25 privately-owned grinder pumps. Seven pumping stations ranging in size from 150 gpm to 1,700 gpm with a total length of force mains of approximately 14,000 feet.

While the specific age of the system is estimated to range between 25 and 150 years old, the material and length by diameter are known based on the Town GIS system. Figure 2-1 shows the material distribution (with PVC being the youngest material, and brick being the oldest known material), Figure 2-2 shows the length of pipe by diameter, and Figure 2-3 shows the entire system.

Figure 2-1: Material and Approximate Age Distribution of Collection System

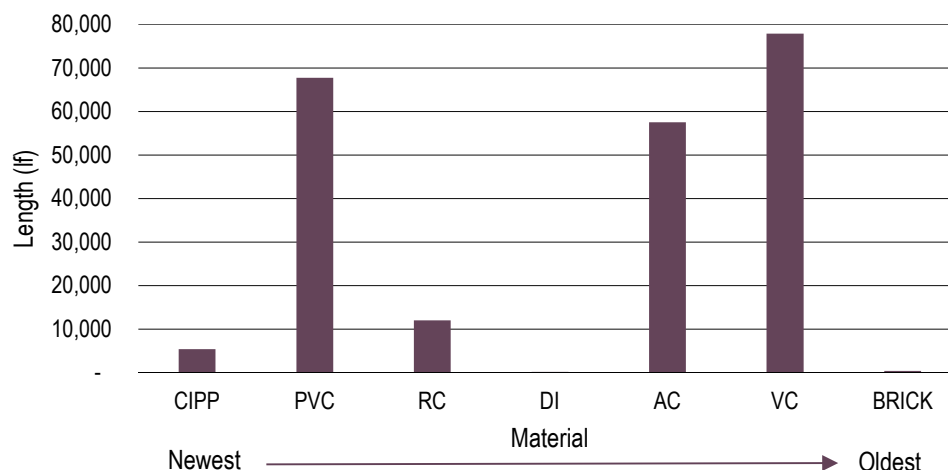
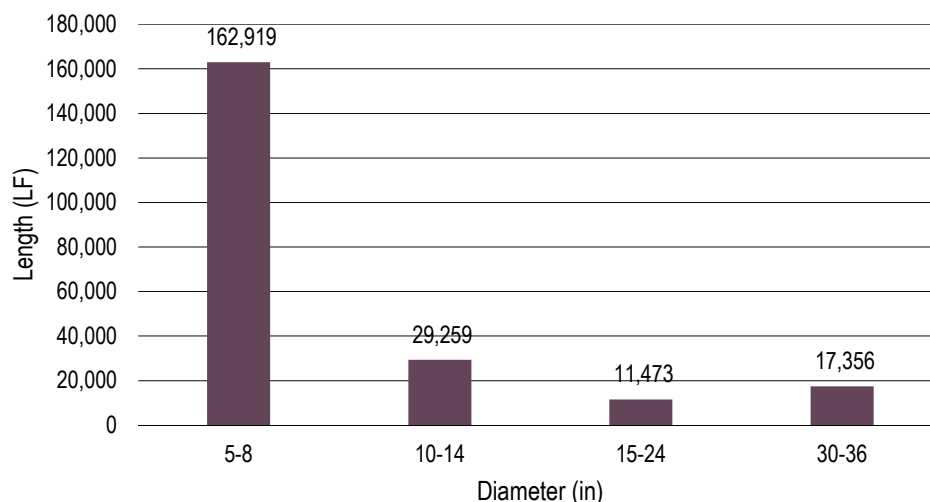
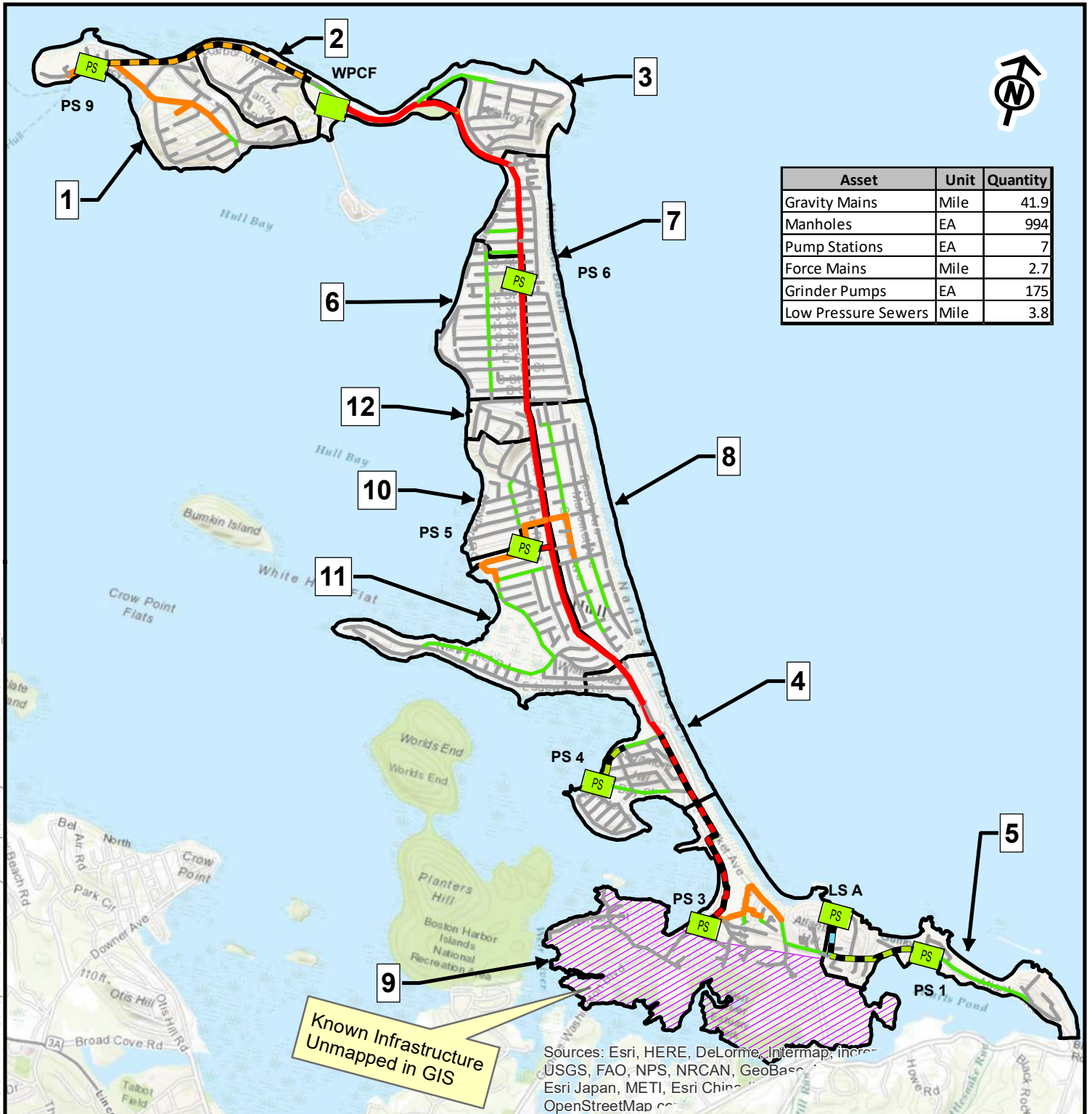












Figure 2-2: Length of Pipe by Diameter





Asset	Unit	Quantity
Gravity Mains	Mile	41.9
Manholes	EA	994
Pump Stations	EA	7
Force Mains	Mile	2.7
Grinder Pumps	EA	175
Low Pressure Sewers	Mile	3.8

Legend

 Pump Station	Force Main (Diam)	Gravity Main (Diam)
 Sewershed	 4-6	 5-8
	 8	 10-14
	 10-12	 16-24
	 14	 30-36

Sewer Collection System Overview

Town of Hull, MA

Figure 2-3



Woodard & Curran shall assume no liability for any of the following: 1. Any errors, omissions, or inaccuracies in the information provided regardless of how caused or; 2. Any decision or action taken or not taken by the reader in reliance upon any information or data furnished hereunder.

SCALE: 1" = 2,920'	DOC: Overview_8.5x11.mxd
DATE: JUNE 2017	PROJECT #: 0217319.02
DRAWN BY: PJL	SOURCE: Town of Hull, ESRI

2.1 Budgeting

Compensation is outlined in Section 5 of the Contract for Operations, and the W&C RFP, pg 10. For additional operation or capital expenditures, change orders from the Contract Operator are submitted and approved by the Town Manager, and Director of Wastewater Operations.

2.2 Monitoring

All pump stations are connected to SCADA, there is no other remote sensing available within the interceptor or the collection system. There is one partially working flow meter at Pump Station 6, which is used to monitor flow conditions in the rest of the collection system. However, Pump Station 9 is not included in this system, and represents a separate sewer shed. See Figure 2-3 for additional sewershed location information.

2.3 Hydrogen Sulfide Monitoring and Control

Since 2015, there have been significant reductions in odor related customer complaints, due in part to the hydrogen sulfide reduction practices implemented in the collection system and at the WPCF. The following projects summarize current hydrogen sulfide monitoring practices: Figures below summarize the hydrogen sulfide levels in the system prior to (Figure 2-4) and after (Figure 2-5) the addition of the following measures, which greatly reduced hydrogen sulfide concentration.

Ferric Chloride Addition: During summer months, ferric chloride is added at the main interceptor Pump Station 6, the last station before heading to the WPCF.

Wet Well Aerators: In all pump stations, wet well aerators were installed to break-up solids and reduce the frequency of necessary cleaning. The wet well aerators are still operating strong.

In-Pipe Bacteria Addition: Bacteria is being inserted to the collection system at 20 locations, to reduce fats, oils and grease as well as sulfide growth.

Figure 2-4: Hydrogen Sulfide Levels during First Year of Operation

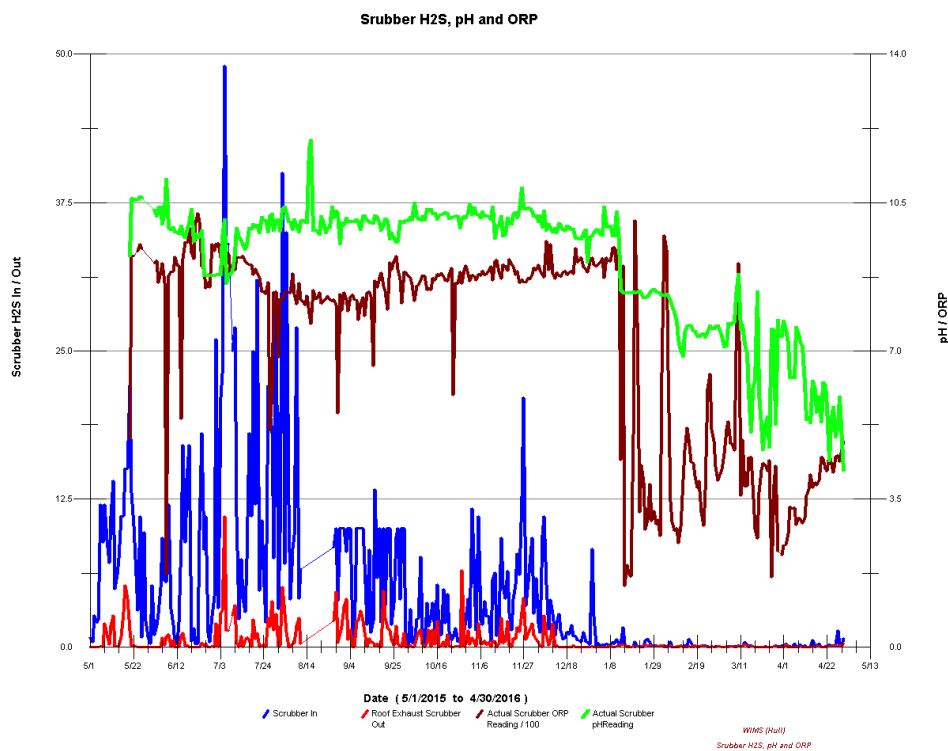
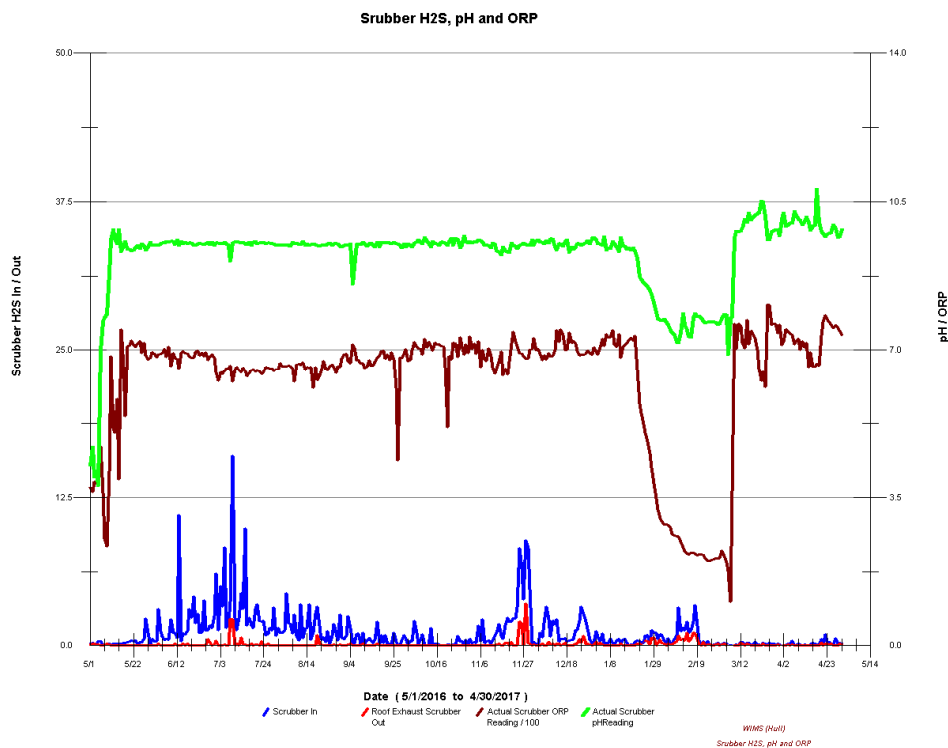


Figure 2-5: Hydrogen Sulfide Levels during Second Year of Operation



2.4 Safety

In April, 2015 Woodard & Curran's Corporate Health and Safety Staff conducted a detailed Occupational Health and Safety review of the site and compiled a report which detailed the findings and produced an audit listing over 250 items (longest list to date) to be addressed. A transitional safety budget of \$169,750 was established by the Town of Hull to address these safety concerns. Correction of these safety related issues noted on the audit list was considered an ongoing priority until completed. The Town of Hull was provided an updated monthly status report of the corrective actions that was included in the Monthly Operating Report and provided to the Hull Permanent Sewer Commission.

With the assistance of Woodard & Curran's Corporate Health and Safety Department, Technical Support, and a dedicated Plant Staff the audit was reduced to (5) remaining items to be addressed as of May 10, 2017. The WPCF will continue to be inspected by W&C Team members and continued preventative and scheduled maintenance is tracked using DoForms.

2.5 Emergency Preparedness and Response

The Contract Operator developed a written Emergency Response Plan (ERP) in August 2016. Town Sewer Department, Town Manager, and Town Emergency Response Committee were coordinated with as a part of the plan. Within the Emergency Response Plan, all the following issues are considered:

- Vulnerable points in the system (critical pump stations to address immediately, low points in the collection system)
- Storm Events and Predicted High Flow Scenarios
- Backup Systems Initiation due to pump failure/generator use
- SSO's
- Internet/Electrical Outages
- Town of Hull Emergency Notification Procedures

The plan is updated as Standard Operating Procedures (SOPs) change, and updated with contact information as necessary. The Key Contact List from the ERP is included in Appendix D.

2.6 Modeling

The Town of Hull does not currently have a hydraulic model of their collection system, but it is proposed to include a hydraulic model as part of Corrective Action Plan objectives.

2.7 Mapping

Town of Hull uses a digitized interactive sewer system GIS database and map, which was created by scanning and digitizing paper plans covering about 85 to 90% of the town's sewers, force mains and pump stations. The GIS map/database was mostly based on the 1986 CDM sewer system map/plan. GIS mapping and attribute data is being updated and supplemented during the Town's pipeline and manhole inspections using a GPS unit and smartphone/tablets.

As a part of the Asset Management and Fiscal Sustainability Plan, information is being updated and detailed further in Utility Cloud®, a cloud-based GIS CMMS for integration and comparison among other assets. See Appendix A for additional details regarding the Utility Cloud transition.

2.8 New Construction

The town charges a connection fee based on the Flow Estimation Table from the 314 CMR 7.15 utilizing a One-Bedroom assumption of 110 gallons a day (e.g. each seat in a restaurant uses X gallons per day – for each 110 gallons a day we charge \$500.00). Of the existing connections, the Town has “tie-in cards” for approximately 3,240 of the 4,497 Hull connections. For gravity sewer lines, force mains and pump stations, there are GIS locations, available through an online GIS web mapping profile created by Kleinfelder. There are paper drawings for many sewer projects available at the wastewater facility, and these are utilized or referenced by field crews on as needed basis. The goal is to transition updating new construction and repairs to the Utility Cloud© CMMS system for tracking and updates.

2.9 Pump Stations

Within the Hull POTW, there are seven sanitary sewer pump stations. The SEMS database provided a complete asset inventory for the Town’s pump stations, but lacked ancillary data (such as asset nameplate information, performance testing and/or consistent component consequence assessments). See Table 2-1 for a summary of the station design information.

Table 1-1: Pump Station Inventory

Asset	Location	Generator	Design Capacity (gpm)	Approx. Age (years)
LS A	Valley Beach Rd.	No*	200	40
PS 1	Atlantic Ave.	Yes	450	40
PS 3	George Washington Blvd.	Yes	1700	40
PS 4	Marginal Rd.	Yes	800	40
PS 5	Draper Ave.	Yes	1600	40
PS 6	L St. Playground	Yes	670	27
PS 9	Main St. High School	Yes	650	40
*Transfer Switch, portable generator connection and portable generator are available.				

The force mains carry the wastewater from each pump station to a discharge point in the gravity network. In general, all force mains are of original installation and consist of ductile iron, except for the force main for P.S.9 which was replaced in 2011 with 10-inch HDPE. Table 2-2 the force mains by pump station.

Table 2-2: Force Main by Pump Station

Pump Station	Diameter (in)	Material	Length
LS A	4	DI	871
PS 1	8	DI	2,138
PS 3	14	DI	4,763
PS 4	8	DI	1,136
PS 5	14	DI	584
PS 6	6	DI	78
PS 9	10	HDPE	4,863

The Town also owns and operates 175 grinder pumps in the southern portion of Town, which connect to a low-pressure force main that is approximately 20,000 LF in length.

3. EQUIPMENT AND COLLECTION SYSTEM MAINTENANCE

3.1 Maintenance Budgeting

A sewer enterprise fund has been established and it includes wastewater collection and treatment operations – collection system maintenance and debt payment for infrastructure improvements. A \$140,000 capital budget is included the contracted operations and the Sewer Department budget includes an additional \$200,000. The Enterprise fund includes costs of administration and of items such as insurance and payments to the general fund for health insurance, pension, support for accounting, legal, treasurer/collector etc. There is a POTW Capital Improvement Funding Tool and Assessment underway, which will include collection system needs, to be presented to the Permanent Sewer Commission for attention.

3.2 Planned and Unplanned Maintenance

For both planned and unplanned maintenance, there are procedures for revising the maintenance schedule, as stated in the Contract. See Section 2.14 of the Contract for additional details.

3.3 Sewer Cleaning

The current operations contract with W&C provides some guidance and quotas for performing routine inspection and cleaning of the collection system, including recommended annual quotas for sewer CCTV, sewer cleaning, manhole inspections, grinder pump replacement and wet well cleaning. These quotas will be reevaluated and reprioritized as part of the CMOM Corrective Action Plan.

For pump stations, there is a wet well cleaning and inspection schedule set by the Contract Operator, which is fulfilled, logged and reported through the SEMS Work Order System. Grinder Pump inspections or maintenance history is maintained by the Town Sewer Department and the Contract Operator. If there are potential issues with the with the grinder pumps, the Sewer Department receives the call and processes a Work Order request through the Contract Operator.

Pipe and manhole inspections are performed in accordance with National Association of Sanitary Sewer Companies (NASSCO) Pipeline Assessment and Certification Program (PACP) and Manhole Assessment and Certification Program (MACP) standards, and recorded in DoForms. Similar to other collection system activities, this process is planned to eventually transition into Utility Cloud®.

3.4 Parts and Equipment Inventory

As stated in the CMOM Self-Assessment, the Contract Operator is in the process of updating the WPCF O&M Manual which will include an updated equipment and parts inventory tracking procedure. See updated inventory in Corrective Action Plan, to be submitted July 31, 2017.

4. SEWER SYSTEM CAPACITY EVALUATION

Collection system overflows occur mostly during wet weather events, and the system does not typically experience overflows during dry weather. The collection system has had some problems with structural sewer line and manhole failures, as well as forcemain failures, in addition to backups caused by debris, FOG, and basement backups. However, the hydraulic limitations in the collection system and the WWTP are a concern only during extreme flow events or infrastructure failures.

Pump Station losses - there have been no pump station losses that have caused sewer overflows in the past couple of years, except for the forcemain issues discussed below.

Structural collapses – some corrosion/deterioration of sewers and manholes have occurred in the past causing structural defects that needed to be repaired.

Forcemain failures – The forcemain for PS 9 corroded and was replaced in 2011 with a new HDPE Forcemain. The forcemain for PS 4 had a break and required repair in early 2014. This forcemain has failed multiple times over the years. 15 feet of the end of the forcemain for PS 3 was lined in the summer of 2016 due to corrosion issues.

The manhole and reinforced concrete pipe (“main interceptor”) where the forcemain for PS 3 discharges, collapsed in 2002/2003 and required an emergency repair.

Sanitary sewer overflows (SSOs) are the result of a failure in the sewer collection system. SSOs can be caused by structural pipe failures, clogged pipes, or hydraulic deficiencies. SSOs have significant consequences including threatening public health, expense of mitigation, potential regulatory action, and damage to the Town’s reputation. Preventing SSOs is the primary goal of the asset management and capital improvement process.

From 2013 through today, the Hull POTW has had 31 recorded SSOs, ranging from single home backups and line blockages to storm events when the entire WPCF needed to be bypassed. As a part of the AOC, the Emergency Response Plan for SSOs was revised and is included in Appendix C.

4.1 Flow Monitoring

Currently there are no system in place except for the treatment facility influent and effluent flow meters. As stated in the CMOM Self-Assessment, the goal is to purchase additional flow meters. Further details are expected to be included in the Corrective Action Plan, to be submitted July 31, 2017.

4.2 Sewer System Testing and Inspection

Capacity was evaluated previously in 1977, 1984 and 1998 the plant has adequate capacity for normal flow, but not for extreme flow events, such as the “No-Name” storm of 1991. Several requests have been submitted in the past to allow for by-passing of extreme flows beyond the capacity of the sewer system; this currently occurs using portable emergency pumps on an as needed basis. Further details are expected to be included in the Corrective Action Plan, to be submitted July 31, 2017.

5. SEWER SYSTEM REHABILITATION

In 2004 and 2009, The Town inspected and assessed its Reinforced Concrete Pipe (RCP) sewer “main interceptor,” and Consultants recommended renewal of approximately 12,300 liner feet of interceptor pipeline based on interceptor segments with PACP structural ratings equal to or greater than 4. The poor structural condition was a result of hydrogen sulfide induced corrosion to the internal pipe wall.

The recommended renewal project was executed through two construction contracts in 2005 and 2010 with an associated cost of \$2.13 Million (in 2005/2010 dollars). The reported cost included construction and engineering, but not the cost of performing the assessments. The two contracts consisted of cured-in place pipelining (CIPP) of approximately 55% of the sewer interceptor, which ranged between 14 and 36 inches in diameter; as well as renewal of 15% of the interceptor manholes.

There have been preliminary evaluations since Woodard & Curran has taken over the Operations and Maintenance of the WWTF in May of 2015, such as evaluating major assets and risk assessment of major forcemain sections. However, a formal strategy and plan of assessment needs to be addressed.

The Town of Hull, MA requested Woodard & Curran complete a preliminary rehabilitation plan for the Gunrock Area, utilizing Closed Circuit Television (CCTV) pipe inspection and manhole (MH) inspection completed during the Spring of 2017. Below is a detailed recommendation of this year’s detailed condition assessment of the sanitary sewer in the Gunrock Area and recommends rehabilitation and probable costs that address structural and operational defects in the area.

5.1 CCTV Review and Sewer Pipe Condition Assessment

CCTV inspection completed by Wind River Environmental during the Spring of 2017 (March 21st – March 29th) utilized National Association of Sewer Service Companies (NASSCO) Pipeline Assessment Certification Program (PACP) inspection protocol and located numerous structural and operational defects including sources of infiltration and inflow (I/I). Wind River completed inspection of approximately 5,200 LF of an estimated 6,200 LF based on the Town’s GIS. Inspections were not completed on Stony Beach Road or portions of Summit Avenue (approximately 1,300 LF of 6-8” sewer pipe).

A count of the type and severity of point defects located in the Gunrock area are summarized in Table 1. These defects are organized by the type of defect as well as the NASSCO PACP rating. The rating system uses a scale of 1-5, where 5 is the most significant defect and may require immediate rehabilitation.

Table 5-1: Gunrock Pipeline Defects

Type of Defect	NASSCO PACP Rating				
	Minor	Minor to Moderate	Moderate	Significant	Most Significant
	1	2	3	4	5
Structural	11	47	37	19	21
O&M	77	1	6	14	0
I/I	67	0	7	4	3
Total	155	48	50	37	24

Defects that have a PACP rating of greater than or equal to 4 should be considered for rehabilitation. The Gunrock area has a total of 61 defects that significant enough to be spur rehabilitation recommendations. Specifically, the inspections located 21 structural defects that were graded as a 5, these defects include broken pipes/holes in the pipe

where voids exist, or soil is visibly entering the pipe. There were no O&M related defects that identified that were a 5, however significant root defects were located along the easement off Atlantic Avenue. There were three I/I defects that were rated as a 5; these include infiltration gushers – or locations of infiltration that appear to be under pressure and “gush” into the pipe segment. W&C estimated I/I to contribute approximately 75 gallons per minute or 108,000 gallons per day. For comparison, this is approximately 10% of the maximum month I/I flow estimate for the year 2016. Defect types are described below with example photos from the Spring 2017 inspection.

Significant Structural Defects: Characterized by cracks, fractures, breaks, and holes in the sewer pipe that cause structural instability. This type of defect can cause sewer collapse, backup, and sinkholes. These defects also lead to the introduction of extraneous groundwater and rain-induced infiltration. Structural defects can lead to costly emergency repairs that cause social, economic, and environmental damage. Through the rehabilitation recommendations made in the following sections, these structural defects can be repaired via trenchless methods (i.e. without excavation) which leads to quicker and less noticeable construction.

Broken Pipe on Atlantic Avenue, Grade 5



Pipe Segment 20957-20958 (Intersection of Stony Beach Rd. and Atlantic Ave.)

Hole with Voids Visible on Gunrock Avenue, Grade 5



Pipe Segment 20966-20969 (Approximately #18 Gunrock Ave.)

Significant O&M Defects: These types of defects are characterized by roots, grease, and debris build up. This type of defect can cause sewer backup, increased maintenance costs, and lead to extraneous groundwater and rain-

induced infiltration. These defects can lead to costly emergency repairs that cause social, economic, and environmental damage. Through the rehabilitation recommendations made in the following sections, these defects can be repaired via trenchless methods (i.e. without excavation) which leads to quicker and less noticeable construction.

Root Ball Large off Atlantic Avenue Easement, Grade 4



Pipe Segment 30008-20979 (Approximately #40 Atlantic Ave.)

Deposits Attached Grease on Atlantic Avenue, Grade 3



Pipe Segment 20967-20965 (Approximately #146 Atlantic Ave.)

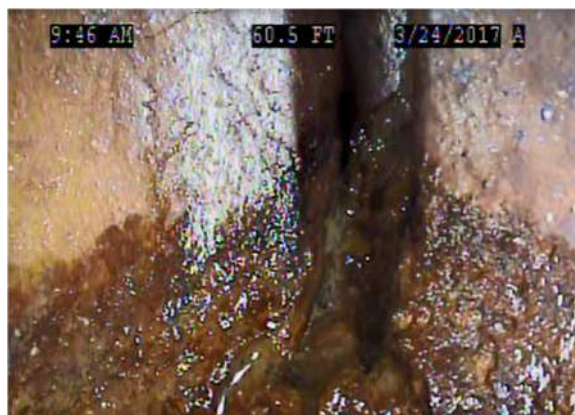
Deposits Attached Encrustation on Summit Avenue, Grade 4



Pipe Segment 20982-20985 (Approximately #18 Summit Ave.)

Significant I/I Defects: These types of defects are characterized varying levels of observed infiltration. These defects record both active infiltration, such as infiltration gushers, and inactive infiltration such as infiltration staining. These defects add extraneous flow to the sewer system increasing treatment costs as well as maintenance on mechanical assets. Infiltration also aids the migration of surrounding soil fines into the collection system which over time can lead to subsurface voids under roadways. Through the rehabilitation recommendations made in the following sections, these defects can be repaired via trenchless methods (i.e. without excavation) which leads to quicker and less noticeable construction.

Infiltration Runner and Staining, Grade 4



Pipe Segment 20964-20966 (Approximately #22 Gunrock Ave.)

Infiltration Gusher, Grade 5

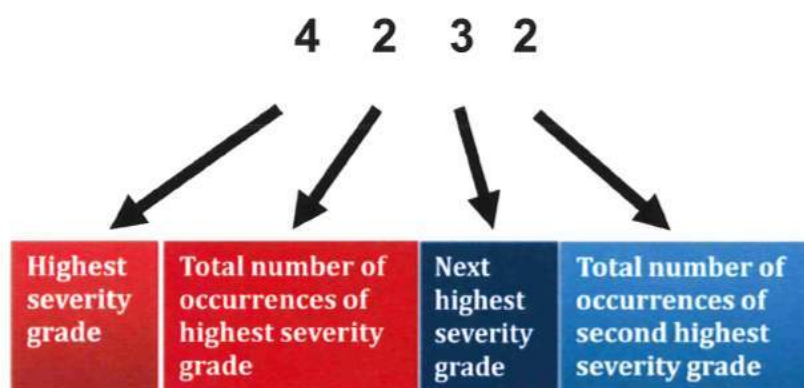


Pipe Segment 20971-20970 (Approximately #120 Atlantic Ave.)

Pipe Inspection Summary and Recommended Rehabilitation: Based on the type of defects located above and utilizing NASSCO PACP coding system, W&C calculated quick overall ratings (QOR) for each pipe inspected. Using the calculated QOR for each inspection, a likelihood of failure of any inspected pipe is equal to the peak defect score located during the inspection. The method to calculate quick ratings is describe in detail below.

Using NASSCO's guidance on pipe rating methods, pipe segments can be rated on a scale of 1-5 as calculated by the defects located during inspection. Using a method called "quick overall rating" or QOR, each pipe is given an overall rating that is equal to the number and severity of the two most sever defects located during the inspection. For example, if a pipe had two "root ball large" (PACP rating = 4) defects and two infiltration drippers (PACP rating = 3), the pipe would have a QOR of 4232 (see Figure 5-1 below).

Figure 5-1: NASSCO Quick Overall Rating System



Using the QOR scores and likelihood of failure scoring, rehabilitation priority was set for all pipe sections. For pipe sections with high rehabilitation priority, W&C reviewed the CCTV inspections and recommended rehabilitation to address the defects located during inspection.

5.2 MH Inspection Review and Condition Assessment

In order to address the known I/I issues that are located in the Gunrock area, Woodard & Curran also inspected 40 manholes via NASSCO MACP (Manhole Assessment Certification Program) Level 1 protocol. The purpose of the NASSCO Level 1 inspection is to complete a basic inventory of manhole parts and condition. The inspection is a

surface inspection and does not require confined space entry. During the inspection, photos of the manhole frame and cover as well as the inside of the manhole were taken. Utilizing W&C staff to complete the manhole inspection and reviewing the photos taken, a set of rehabilitation recommendations were compiled with the aim of addressing significant structural concerns and infiltration and inflow. One concern for the Town is surface inflow (entering through the pick holes of manhole covers) during storm surge events in low lying areas and therefore the manholes were inspected for evidence of inflow staining.

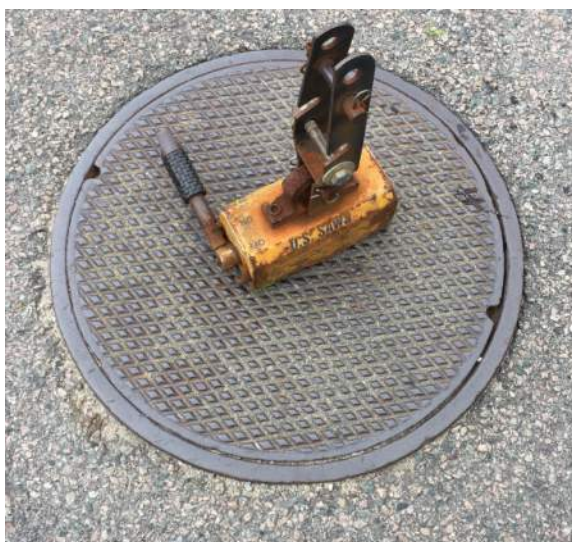
In general, the Town's manholes in this area are composed of either brick or precast concrete and in good condition. The manholes in the Gunrock area are in much better condition than the sewer pipes and only minimal rehabilitation is being recommended in this memo – much of the recommendations aim at replacing frames and covers to eliminate surface inflow or filling missing mortar in the manhole chimney and walls. The following table summarizes the defects found during the Spring 2017 manhole inspection program.

Table 5-2: Spring 2017 Manhole Inspection Defects

Defect	Count
Rim Inflow Probable	11
Damaged Frame and Cover	6
Chimney Defective	11
Wall Defective	13
Bench/Channel Defective	5
Debris	2

Surface inspection of manholes in the Gunrock area revealed that almost all manholes (except the manhole upstream of PS 1) are structurally stable. No significant defects were recorded. Approximately 10,000 gallons per day of infiltration was estimated to be contributed from MH defects. Many of the manholes have covers with two pick holes that allow surface water inflow to enter the collection system. Thirteen manholes show defective walls that have light to moderate infiltration. Four of the manholes have defective bench or channels which may lead to increased maintenance and/or infiltration. Photos below show examples of common defects found during the Spring 2017 inspection program.

Manhole Rim with Pick-holes Leading to Surface Inflow



MH 20970 (Approximately #134 Atlantic Ave.)

Damaged Frame and Cover



MH 30006 (Intersection of Atlantic Ave and Montana Ave.)

Defective Chimney



MH 20976 (Approximately #76 Atlantic Ave.)

MH20962 (US of PS 1) with Aggregate Showing



MH 20962 (Intersection of Atlantic Ave and Montana Ave.)

Wall Defective (Light Infiltration)



MH 20967 (Intersection of Atlantic Ave and Gunrock Ave.)

MH Wall Defective (Light Infiltration, roots)



MH 30008 (Approximately #38 Atlantic Ave.)

MH with Defective Bench & Debris



MH 20957 (Intersection of Atlantic Ave and Stony Beach Rd.)

As evidence of the photos above, many of the manhole defects were not significant and do not require immediate attention, but may be more cost-effective to rehabilitate while performing sewer pipe rehabilitation as well. It should be noted that manhole inflow dishes were considered for this analysis, however were not recommended. Many of the manhole frames would not accept inflow dishes due to the lack of a bottom lip and therefore the inflow dishes would have to sit on the top lip of the frame. This can cause the manhole rim to not sit flush with the existing pavement and

therefore is not a suitable rehabilitation method. Hence, replacement of manhole frames and/or covers was selected as the appropriate rehabilitation method and although this may require light excavation it serves as a better long-term solution.

5.3 Summary of Recommendations and Next Steps

The recommendations above are aimed at reducing the Town's risk of sewer failure in the Gunrock Area by eliminating significant structural defects and reducing infiltration and inflow. This will lead to reduction of emergency repair costs and costs associated with treatment and transport of extraneous wastewater flows. See Figure 5-2, on page 5-12, which shows assets selected for rehabilitation in the Gunrock Area.

Recent construction costs for similar work in Massachusetts to estimate unit costs for the recommended pipeline rehabilitation. These estimated unit costs are summarized in the table below. These costs include estimated installation costs.

Table 5-3: Cost Estimates for Pipeline Rehabilitation

Item	Unit	Diameter	
		6-8"	10"-12"
Heavy Clean and Inspect	LF	\$10	\$10
CITS	Per Joint	\$30	\$30
CITS Service	Per Joint	\$150	\$150
Cut Service	EA	\$2,580	\$250
Root Treatment	LF	\$10	\$10
Short Liner	LF	\$430	\$450
CIPP (MH-MH)	LF	\$60	\$60
Open Cut	LF	\$250	\$250
Lateral Inspection	EA	\$1,000	\$1,000
Lateral Line (5-feet)	EA	\$4,200	\$5,300

To determine rehabilitation costs for manholes in the Gunrock Area, unit costs were developed for recent and similar construction projects in Massachusetts. The table below summarizes the unit costs for each of the recommended rehabilitation methods. These costs include estimated installation costs.

Table 5-4: Cost Estimates for Manhole Rehabilitation

Item	Unit	Cost
Clean	EA	\$500
New Watertight Cover	EA	\$600
New Watertight Frame and Cover	EA	\$750
Rebuild Bench & Channel	EA	\$2,000
Chemical Root Treatment	EA	\$2,000
Cementitious Liner	VF	\$150
Epoxy Liner	VF	\$450
Remove & Replace	EA	\$12,000

The recommendations above should be considered as preliminary design and more detailed design will be necessary for proper bidding and construction. The table below is a summary of the rehabilitation costs outlined with contingency, construction, engineering design, permitting, and construction administration.

Table 5-5: Cost Estimate for Gunrock Rehabilitation

Item	Unit	Quantity	Estimated Cost
Gravity Sewer Rehabilitation	LF	6,115	\$500,000
Sewer Manhole Rehabilitation	EA	27	\$50,000
Subtotal			\$550,000
Contingency (30%)			\$170,000
Total Construction Cost			\$720,000
Engineering Design, Permitting, and Construction Administration (25%)			\$180,000
Total			\$900,000

It is likely that the Town may want to consider using the State's Clean Water State Revolving Fund (CWSRF) as funding source for this project. The CWSRF has a set of deadlines the Town must meet to be eligible for the funding with the goal of bidding the project in the Spring of 2019. An example of the SRF-related deadlines are as follows:

Table 5-6: Example of SRF Timeline

Item	Anticipated Date
Complete Project Evaluation Form	8/11/2017
Intended Use Plan Released	1/1/2018
Spring Town Meeting Approval	5/7/2018
Final Design to MassDEP	10/15/2018
Bidding & Award	1/1/2019
Start of Construction	4/1/2019
End of Construction	8/1/2019



Figure Exported: 5/18/2017 By: plynos Using: C:\Users\plynos\Desktop\Hull Replica\GIS\MXD\2017.04.05 IM.mxd

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DRAFT

**Gunrock Rehabilitation
Recommendation**

Woodard & Curran shall assume no liability for any of the following: 1. Any errors, omissions, or inaccuracies in the information provided regardless of how caused or; 2. Any decision or action taken or not taken by the reader in reliance upon any information or data furnished hereunder. Data Sources:

PROJECT #: 217319.00
DATE: MAY 2017
SCALE: 1" = 400'

FIGURE 5-2

6. REFERENCES

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- Cavaleri, F., N. Rogers and R. Cranmer, Professional Services Group. "Wrestling with High Storm Tides at the Hull Water Pollution Control Facility." Massachusetts Water Pollution Control Association. (1995). Print.
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APPENDIX A: ANNUAL OPERATING REPORT: YEARS 1 AND 2



HULL WATER POLLUTION CONTROL FACILITY

TWO YEAR
TRANSITIONAL REPORT
5/01/15 - 4/30/17

ANNUAL OPERATING REPORT



woodardcurran.com

COMMITMENT & INTEGRITY DRIVE RESULTS



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1 EXECUTIVE SUMMARY

Woodard & Curran was engaged by the Town of Hull to operate and maintain their Water Pollution Control Facilities on May 1st, 2015. One of the contract deliverables was to provide an Annual Operating Report which summarizes the operations for the previous year and highlights major issues moving forward in the upcoming year. With respect to transitional services “Time was of the Essence” and Woodard & Curran was directed to provide complete supervision, operation, maintenance, management, and repair services to address all operational issues in a timely manner. A mutually agreed focus was placed on operating the water pollution control facilities to meet all the effluent characteristics and sampling requirements as defined in the Town’s current NPDES Discharge Permit while addressing the contract deliverables, facility demands, and any issues that may arise.

With the extensive demands of these transitional requirements the first Annual Operating Report covers and highlights the pertinent information and activities that occurred over the first two years of operational services.

The following time line summary was created by using the information provided to the Town of Hull in the contract deliverable Monthly Operating Reports.

May 2015:

- Woodard & Curran assumed full Operation & Maintenance responsibilities for the Hull Water Pollution Control Facility on May 1st, 2015. Transitional work begins with a focus on water quality, safety, contract deliverables, evaluating and documenting the existing conditions.
- A detailed tour was provided to the Town Manager and the Sewer Commission members to discuss and assess the current conditions of the facilities when transfer of operations occurred.
- High Flow Management Plan is stressed and formulation begins.

June 2015:

- Extensive SCADA system reliability and efficiency improvements are implemented and will be ongoing process.
- A fixed (4) gas metering system was installed in the Headworks to monitor and protect the staff from atmospheric hazards such as hydrogen sulfide. The odor scrubber is found to be very problematic after extensive trouble shooting.
- The mechanical screen at the headworks isn’t operable and is causing many operational issues at the WPCF.
- Reporting system to meet contract deliverables under development (Daily, Monthly, and Work Orders).
- Facility staffing and technical support needs begin to be addressed with interviews and the hiring process initiated
- MA DEP (Dave Burns) and the EPA (Dave Turin) visited the site and inspected the facility.

July 2015:

- Sulfide levels in the collection system and WWTP were found to be extremely high. Extensive work was done throughout the month to control this issue. Monitoring and fine tuning of the BOC addition at Pump Station #3, automating pump controls through the SCADA system, and chemical addition (ferric chloride and sodium hypochlorite) at various strategic locations throughout the facilities.
- The poor condition of various components and equipment throughout the facilities began to surface and cause operational problems. Mechanical screen allowing a considerable break through of rags causing grit system issues, multiple clogged pumps, and the overflow of the gravity thickener. The primary clarifier stopped working due to a torque overload and the need to by-pass, empty, repair, and quickly return to service.
- A power failure that exemplified the vulnerability of the plant communications and pump station telemetry.
- A tour was provided to the Town's insurance company (Great America). Staffing plan was addressed with multiple hirings.

August 2015:

- Begin working on the Arc Flash Study for the wastewater treatment plant and the associated pump stations.
- Continued work on the safety and SCADA issues through the facilities.
- Odor scrubber continues to be problematic resulting in on-going troubleshooting and repair work.
- Scherbon started the installation of the new mechanical screen.
- SPINTECH performed vibration analysis on the influent pumps and determined Pump #5 will need to be pulled and rebuilt with Pump #3 to shortly follow.
- Standard Operating Procedures(SOP) being developed (ongoing) with one created specific to the responsibilities of the sludge loading truck drivers, due to a spill and the need to file an SSO report.
- Extensive and ongoing pump station issues, troubleshooting, and repair work.

September 2015:

- Initial Arc Flash Analysis Report completed and staff are proceeding with the mitigation of issues described in the report.
- Sulfide levels in the collection system and at the treatment facility continue to be very high. Costly chemical addition is necessary to keep the odors under control.
- Continued work on the High Flow Management Plan.
- Extensive work done to document the existing conditions throughout the facilities and create work orders for a means of tracking and correcting.
- SCADA communications continue to be a critical ongoing issue and a back up cellular modem was installed to protect operations and alert the operators of alarms.
- A coordination meeting was held at the Town Hall (9/9/15) to discuss current and future issues associated with the Operations.
- A capital planning meeting was held at the WPCF (9/24/15) to discuss current conditions and needs.
- Two meetings were held at the Town Hall (9/29/15) to discuss the pursuit of grants for D Street Station.

October 2015

- New Arc Flash labels created and affixed to the panels at the WPCF.
- Elevated sulfide levels continue to be problematic.
- Safety, compliance, SOP development, and electrical support staff onsite various times throughout the month.
- LIGHTSHIP GROUP in on October 19th to perform vibration analysis on a number of different pieces of equipment.
- Extensive evaluation, troubleshooting, and review of quotes to correct the influent pumps.
- Chesterton provided an assesment report which showed significant loss of efficiency on all of the pumps.
- Odor scrubber needs to be serviced and upgraded.
- Lack of HVAC in the plant's main building noted as the cause of many corrosion issues to the plant electrical equipment and components.
- A meeting was held at the WPCF (10/21/15) to discuss a Capitol Improvement Plan, Resiliency, and Station D.

November 2015

- Equipment repair and operational efficiency improvements continue to be a ongoing, focused effort of the staff.
- Lockout Tagout procedures for all of the equipment are under development and nearly complete (85%).
- Concentrated and ongoing efforts to correct the many electrical safety issues throughout the Facility and associated grounds.
- Woodard & Curran's technical support staff continue to provide extensive support to the Project, Capital Planning and prioritizing of corrective maintenance as well as equipment replacement.
- A signed change order issued to use "Bond and Town Article Funds" for collection system work on 11/23/15 and a meeting was held at the Town Hall (11/23/15) to discuss a mitigation grant.

December 2015

- Arc Flash labeling at the pump stations completed.
- Sulfides starting to diminish due to the colder weather but still remain an issue.
- Continued work on corrective maintenance, transitional items, High Flow Management Plan, and the development of standard operating procedures for bypass pumping at the pump stations.
- All pump station wet wells were inspected; Stations 4, 5, and A were cleaned by Wind River Environmental with disposal of residuals at the Town Landfill.
- The rotary drum thickener was shut down for the winter and correction of the many system deficiencies commenced.
- The roof on the main building leaks in multiple areas and quotes to correct are being solicited.
- A meeting was held at the WPCF (12/3/15) with Tighe and Bond to discuss the required HVAC system upgrade.
- Several meetings were held during the month to discuss funding and plan for the capital repairs for Pump Station #3.

- Continued capital planning with a focus on the priorities and the completion of the arc flash recommendations.
- Staff wastewater license renewals with the State of Massachusetts.
- Salinity measurement program resumed at all pump stations to monitor and track possible areas of infiltration in the collection system.

January 2016

- Correction of the safety related issues noted on the audit list ongoing and is a priority until completed. Corporate Health and Safety staff onsite to assist with compliance.
- A tour was provided to the representative of the Town's insurance company.
- Process changes to the return activated sludge and wasting procedures were implemented to determine the effects and control of the persistent sulfide formations and odors.
- All wet wells were inspected and Stations A, 1, 4, 5, and 9 were cleaned by Wind River Environmental on 1/21/16 with disposal of residuals at the Town Landfill.
- EESCO on site (1/25/16 & 1/26/16) to work on correcting the Arc Flash recommendations and perform thermographic imaging on many of the electrical panels to determine possible problem areas, component issues, and connection issues.
- Pump station isolation valves (most notably Station #4) are an issue and a hindrance to the corrective maintenance required.
- SCADA communication with the pump stations consistently fails and is an operations issue that has to be corrected. Solicitation of quotes for a new base station that hooks up to an antenna for radio use in Town is being sought.
- Meetings throughout the month for Pump Station #3 capitol repairs, electrical system corrections and repairs, High Flow Management Plan, EPA CREAT program, current conditions and capital management to correct, and the need for a Comprehensive Facility Plan.
- Plant was staffed for a weather related power loss event on 1/10/16. A blown transformer caused three separate outages during the late day/evening hours that required attention.
- Plant was staffed for a high tide period on the weekend of 1/23/16 - 1/24/16. Flows were impacted due to high tides and I&I issues but there were no major process changes necessary.

February 2016

- Correction of the safety related issues noted on the audit list and the Arc Flash Analysis ongoing and a priority until completed. The RELT breaker for the 750 kw generator is still an open item.
- Evaluation of the odor control plan for 2016 with various proposals being considered. Process changes continue to be evaluated to determine the benefit in regards to sulfide production and odor reduction..
- Tier II Hazardous Material & Chemical Inventory report completed, "Air Source" collection of information and permit filing underway, determination of the need to file a "Notice of Intent" for the Storm Water Permit, Annual Sludge Report completed and filed with the technical support of W&C corporate office..
- Continued extensive work to document the current conditions of the facility, buildings, structures, and equipment to create work orders for the needed repairs and maintenance related work.

- Meetings throughout the month for Pump Station #3 capital repairs, electrical system corrections and repairs, High Flow Management Plan, EPA CREAT program, current conditions and capital management to correct, and the need for a Comprehensive Facility Plan.
- Facility had higher than normal flows on 2/9/16 – 2/10/16 due to rainfall and storm tidal surges. Facility and pump stations monitored for the entire storm period. No significant changes to the plant except for a short period of time when the process was changed to the step feed/contact stabilization mode. Staff was released as the flows dropped to normal levels.
- Wind River Environmental was on site for several days to flush, vacuum, clean manholes and sewer lines in the Gunrock area. Weather events caused heavy inflow and infiltration in the collection system. They were also on site 2/18/16 – 2/19/16 to inspect manholes on Nantasket Avenue and to vacuum and clean manholes by the Hotel that had accumulated grease and debris.

March 2016

- An electrical shutdown at the WPCF occurred on 3/9/17 so that the Hull Light Department could change out the fuses in accordance with the recommendations in the Arc Flash Analysis Report.
- W&C technical support was on site to collect samples from the plant piping and pump stations for an asbestos determination. All results came back negative.
- The odor scrubber was shutdown and two days were spent inspecting, major acid cleaning, and servicing the system.
- Continued meetings for the Pump Station #3 capital repairs. Hydratech was on site 3/15/16 to assess the force main valve and attempts to render operable were unsuccessful.
- Discussions regarding the replacement of the influent isolation gate.
- Continued improvement of the High Flow Management Plan based on recent storm events.
- Meetings to discuss/evaluate the EPA CREAT Program proceeding with a follow up two day workshop in Hull to be scheduled.
- A meeting was held on 3/29/16 at the Town Hall to discuss the AOC-CMOM order from the EPA.
- Continued work on the capital planning and prioritizing of repairs, and the end of the year financial reports and adjustments.

April 2016

- Continued work on the safety related audit items and the Lockout/Tagout procedures are approximately 95% complete. EESCO completed the final adjustments to the trip settings in accordance with the Arc Flash Analysis report.
- Odor scrubber work was completed and put back into service with considerable improvement. After an extensive review of vendors, the “In-Pipe” proposal for odor control using bacterial addition was selected for the collection system.
- The Hull Fire Prevention Captain Johnson toured the facility on 4/19/16 and discussed the policies related to fire prevention permits, confined spaces, fire watch, and hot work permits.
- Installation of three different aeration/mixing systems for pump station wet wells (A, 3, and 5) were completed and performance will be closely monitored.

- Continued work on the capital planning and prioritizing of repairs, end of the year financial reports and adjustments, High Flow Management Plan, EPA CREAT, and the need for a Comprehensive Facility Plan.
- Meeting with the Permanent Sewer Commission to discuss collection system call out procedures, communications, and the need for organizing the sewer maps and scanning of tie cards.

May 2016

- Continued work on the safety related audit items (approx. 80% completed) with technical support provided from W&C Health and Safety staff.
- Equipment repair and operational efficiency improvements continue to be a ongoing focused effort of the staff.
- Pump station wet well aeration/mixing system performance assessed and the preferred unit was the Medora “Grid Bee” system to be recommended for the remaining (4) stations.
- Continue to fine tune the various reports and the efficiency of the implemented technology such as DoFORMS, SEMS, and HACH WIMS with a goal of getting the information on the server and minimizing the use of paper.
- Continued work on the capital planning and prioritizing of repairs, High Flow Management Plan, EPA CREAT, and the need for a Comprehensive Facility Plan.
- Financial meetings held with the Town to discuss contract year financial close reports, necessary documents to be submitted, adjustments, and the status of the accounts.

June 2016

- Continued work on the safety related audit items (approx. 85% completed) with technical support from W&C Health and Safety staff. Confined space training provided to WPCF staff that was attended by the Hull DPW and Fire Department (6/23/16). Update and organize the chemical safety data sheets (SDS) to comply with the updated Hazard Communication requirements.
- Continued work on the problematic automatic chlorine residual systems to get system automated for more efficient dosing of sodium hypochlorite and sodium bisulfite. A second unit was set up to run parallel to the existing unit and both are getting tracked for trends/accuracy in the SCADA system.
- Two W&C interns on site throughout the month to work on CMOM and other various projects.
- Continued working on Capital Planning, Pump Station #3 upgrades, AOC-CMOM, and the salinity measurement program at all pump stations for I&I tracking purposes.
- Compiled Unauthorized Discharge Reports from 2009 to 2015 and modified the doFORMS Sanitary Sewer Overflow reporting format.

July 2016

- Sulfide levels high throughout the month due to warmer weather and water temperatures but the chemical feed systems and the odor scrubber are handling the loadings well. Ferric chloride feed started at Station #6 (7/20/16) and the “In Pipe” full scale trial is operational and being evaluated at all stations. The “Vapex” trial used to oxidize sulfides and eliminate hydrogen sulfide continues at the headworks and its effectiveness is still undetermined.

- Extensive collection system work conducted throughout the month and all associated generators were exercised weekly without a load and once during the month under full load.
- Continued working on Capital Planning, Pump Station #3 upgrades, AOC-CMOM, salinity measurement program at all pump stations for I&I tracking purposes.
- Compiled collection system maintenance records for Inflow/Infiltration improvements. Drafted an Emergency Response Plan for Sanitary Sewer Overflows, and submitted an Unauthorized Discharge Summary to the EPA and the Mass DEP.

August 2016

- Continued work on the safety issues, updated the audit list, and prioritized the remaining items. Received the RELT breaker for the 750-kw generator, EESCO awarded the installation work and began fabricating an enclosure.
- A mock High Flow Management Drill was conducted on 8/24/16 and the findings (lessons learned) were incorporated into the High Flow Management Plan.
- Continue to fine tune the various reports and the efficiency of the implemented technology such as DoFORMS, SEMS, and HACH WIMS with a goal of getting the information on the server and minimizing the use of paper.
- Continued working on Capital Planning, Pump Station #3 upgrades, AOC-CMOM, and end of the year financial reports and adjustments.
- Ongoing discussions on the collection system “Dig Safe” mark outs. Requests are much more frequent than expected.
- Organization of the sewer maps and consolidation to the 2nd floor “FW Room” completed.
- Continue to assist the Sewer Commission and Regulatory Agencies with the AOC-CMOM issue. Compile pump station run times and wet well levels for the I&I report, drafted the Emergency Response Plan and I&I Control plan for review, and incorporated the Town’s revisions into the Plan. Submitted final documents (Deliverables 2 & 3) to the Mass DEP and the EPA on 8/31/16.

September 2016

- Sulfide levels are high due to the warmer weather and water temperatures but with the optimization work done on the ferric chloride injection and the full-scale trial of “In-Pipe” bacteria addition operable at all stations there were no odor complaints during the month.
- Flood door repairs begin with a goal of bringing all doors back to operating condition with working latches, installing grease fittings on all latches and moving parts, proper door alignment and installing large door supplemental support brackets. Most of the doors are inoperable with corrosion, rust, and broken latches.
- Continued extensive work to document the current conditions of the facility, buildings, structures and equipment to create work orders for the needed repairs and maintenance related work.
- Continue to fine tune the various reports used throughout the operations: Daily Rounds, Station Inspections, Work Orders, Dig Safe, Sanitary Sewer Overflows, DPW Call Outs and Blockages are all paperless and data is being linked to the HACH WIMS system.
- Continued discussion regarding the replacement of the influent isolation gate. Drawings have been updated and ready to out source the gate fabrication

- CMOM self-assessment work conducted, meeting held with the client, and an updated checklist was produced.
- Staff were on call for the projected high winds and rain on 9/5/16 but no power or flow related issues occurred.

October 2016

- Continue to work on addressing the safety audit items with efforts focused on Pump Station and Plant electrical corrective work, fall protection issues, and signage and labeling. No lost time incidents or OSHA recordable with approximately 88% of the audit completed.
- No NPDES exceedances or Sanitary Sewer Overflows reported for the month.
- No odor complaint call outs for the month with ferric chloride feed at Pump Station #6 continued and the "In-Pipe bacterial addition and the odor scrubber working well. There were (3) grinder pump call outs during the month and after (18) years of operating service dating back to 1998 the original pumps are failing and it isn't cost effective to repair them anymore. New replacements are being obtained for these units with an inventory maintained at an affordable price. Numerous "Dig Safe" call outs have been completed and documented on a monthly work order report with on-going discussions with the Town due to the extremely high number of requests placed on the staff.
- Staff were on call for the projected storm during the first week of October with preparation for heavy rain and winds from the hurricane. No power or flow related issues occurred.
- Working with the Town on UST return to compliance issues. Set up the MA DEP Data Management System for UST reporting and return to compliance, third party review, insurance and financial needs, with tank inspection and testing tentatively scheduled for November 2016.
- Continued discussion and review of options for the replacement of the influent isolation gate, high flow management plan review based on the mock drill, and the need for a comprehensive facility plan actively discussed. Assistance provided to the Commission for the AOC-CMOM and the CMOM self-assessment checklist was finalized and submitted to the regulatory agencies.

November 2016

- There were no NPDES exceedances or SSO's reported, (2) grinder call outs, and numerous "Dig Safe" mark outs completed. The CMMS program (SEMS) continues to be updated for efficiency.
- Pump station wet wells inspected, generators exercised, and the load bank testing conducted. Flood door repair work and restoration continued to restore operational functionality.
- Working with Waterline Industries to assist with several maintenance related issues that include: Secondary clarifier #1 rake mechanism, Sludge line replacement in the basement, Station and valve replacements, By-pass channel gates and a manual bar screen installation, and Secondary building sump pump repairs.
- Continued work with the AOC-CMOM, High Flow Management Plan, Capital Plan, UST compliance and the Town's Insurance Company to address items of concern such as the overhead GT electrical line and the masonry deterioration of the block buildings.

December 2016

- Continue to address safety related items noted on the audit list. Mitigation of Arc Flash Analysis issues a priority. The RELT breaker for the 750 kw generator was installed by EESCO on December 6th, 2016 and completion of all the necessary work in the report expected to be done by early January, 2017.
- There were no NPDES exceedances, (2) SSO's reported, (3) grinder call outs, numerous "Dig Safe" mark outs completed, and no odor complaints for the month.
- E.I.S. was invited to the facility to assist with instrumentation issues, questions and concerns. Evaluation of various probe assemblies as well as providing input on pump station SCADA and communications options conducted.
- Commercial Boiler on-site to survey the existing HVAC systems, look for possible areas to upgrade, discuss short and long term options, and performed corrective maintenance on the lab exhaust system.
- Extensive maintenance work (corrective and preventative) performed through out the Facility and associated grounds with continued updating and improvements to the CMMS Program.
- AOC-CMOM, High Flow Management Plan, Capital Plan, UST compliance and Pump Station #3 on-going issues that remain a priority.

January 2017

- Continued work on the site safety audit (approximately 91% completed), electrical and plant structural issues being assessed, Lockout/Tagout procedures (99% completed), annual fire extinguisher inspections conducted by Plymouth County Fire Extinguisher Services.
- No odor complaints, NPDES Permit Exceedances, Sanitary Sewer Overflows, or grinder pump call outs but once again there were numerous "Dig Safe" markouts during the month.
- Rotary drum thickener shut down for the winter and corrective maintenance repairs are scheduled and will be conducted while off line.
- Continue to assess the replacement of the influent isolation gate, requesting information and quotes from vendors to replace the clarifier mechanism drive assemblies due to their poor condition, addressing of the Insurance Companies items of concern, updating of the High Flow Management Plan, and means to resolve the Pump Station #3 issues.
- Facility planning for the winter storm in late January had round the clock staffing in anticipation of power outages and high flows from 1/23 to 1/25. Flows peaked on 1/24 but staff kept the facility operational without any biological process interruptions. The Gunrock area had flooded streets due to tidal surges and pump station #1 had to operate continuously for 24 hours. Peak flows at the treatment plant were noted to be approximately 7.5 MG at 9am on 1/24/17. Compliance sampling done throughout the storm with no noted violations.
- Continued assistance on the AOC-CMOM with the Town and Regulatory agencies, as well as the Capital Planning and priority list development.

February 2017

- Continue to work on the safety audit items, shift some of the corrective work to the Capital budget, and develop a site-specific respirator program for the Hull WPCF.
 - No odor complaints, NPDES Permit Exceedances, Sanitary Sewer Overflows, (3) grinder pump call outs and numerous “Dig Safe” mark outs during the month.
 - Annual sludge report for 2016 completed and submitted using the new electronic reporting format on 2/10/17.
 - Technical support from Woodard & Curran staff member Kristina Richards:
- Site visit to review the progress status of the “No Exposure” Storm Water Pollution Prevention Program. A short list of items needing to be addressed was compiled and the work completed. Filing of the report to the Regulatory Agencies was done on 2/24/17.
 - Tier II Chemical Inventory report was compiled for calendar year 2016, filed electronically through MEMA and a copy sent to the local emergency planning committee (Hull Fire Department)
 - Provisions to dispose of the obsolete/hazardous chemicals left on-site from the previous wastewater facility Operations Company researched and arranged
 - Hazardous waste review conducted – generator numbers previously used researched
 - Compliance matrix/spreadsheet that will allow for tracking of all compliance date milestones being developed
 - Conducted a staff training needs for the upcoming year and submitted registrations for the various courses that were available
 - The Town of Hull signed a Change Order with Woodard & Curran for Engineering Services on February 14, 2017.

March 2017

- Continued work on Safety audit list to address outstanding issues. SOP’s for mechanical work at the pump stations being developed with the confined space requirements considered. Annual crane/hoist inspections completed.
- There were no odor complaint calls in March. Sulfide generation from the primary clarifier and gravity thickener operation continues to be low. Continue to pump primary sludge [PSL] into aeration system for more oxidation of organics before wasting to the gravity thickener [GT]. “In-Pipe” full scale trial for bacteria addition continues. All dosing stations operational. Refill units with new bottles on March 16, 2017. Mixing systems/aerators all functional at the pump stations, except for pump station #3.
- There were no permit exceedances for the month of March. There was one SSO event in March on 3/8/17 at 76 Atlantic Ave., sewage leaking up through ground to the surface in wooded area. Tree roots caused an obstruction in the “cross-country” line and back-up through the VC pipe.
- An “Updated Notice of Hazardous Waste Activity” filing was prepared for submittal to the MADEP, that includes the change of operator to Woodard & Curran, update of the facility’s hazardous waste generation status to reflect that the site as a Very Small Quantity Generator (VSQG) of not only state-regulated waste oil but also EPA-regulated hazardous wastes (“RCRA” wastes).
- Planned storm coverage for March 13/14 blizzard/storm event with staff coverage and equipment placement. Actual conditions were less than expected. No power losses or significant issues.

- Held several discussions with Town, Kleinfelder, and WindRiver to set up for sewer line cleaning and CCTV inspections. The work was scheduled for streets that are due for upcoming paving projects. Daytime work was commenced during the week of 3/20/17. For the main interceptor areas of concern, cleaning and CCTV work was scheduled to follow the initial targeted areas. WindRiver to provide all video and reports.
- Godwin & Emergency Bypass Contingencies: Currently a layout and design for the permanent location of the Godwin pump is being worked on. In addition, a temporary plan for the Godwin pump is underway to use the pump has a headworks bypass to conduct multiple repair / construction projects inside the headworks. Quotes have been requested from bypass contractors to purchase HDPE piping for this headworks bypass use. Additional emergency contractor support for bypassing at all pump stations and plants is being evaluated with Godwin, United Rentals and Baker.
- Influent Gate Design – 3 Different Vendors were requested to provide quotes and drawings for review based on headworks drawings and site tours. All 3 quotes have been received and reviewed for recommendation to the Town in April.
- Continued discussions between the Sewer Department, W&C, and phone system provider to review emergency notification procedures during weekends and off hours. Goal is to have a more consistent “call tree” procedure and possibly eliminating the on-call pager.
- Continued assistance on the AOC-CMOM with Town and regulatory agencies with a draft outline of CMOM Annual Report produced (for due date March 30)
- Created Team Site for Sharing Documents and began uploading record drawings/other Change Order #05 Deliverables
- A preliminary scope of the work was prepared for the hydraulic model for the Hull interceptor from Water Street to the WPCF. The model will show the interceptor horizontal and vertical locations as well as estimated flow in each section of pipe during dry weather (low flows) and wet weather (high flows). The model would use existing GIS and record drawings. Additional time will be needed to review available flow data and incorporating the flow data for each sewer basin (i.e. the magnitude and location of flow entering the reinforced concrete interceptor). (52) Manholes along the main interceptor were inspected and measured on Feb 22-23, 2017.
- Worked to develop plan and schedule cleaning and CCTV work to assess sewer condition prior to planned 2017 roadway paving. A list of areas was provided by the DPW. Met in early March with Town, WindRiver, Kleinfelder, staff to develop & finalize scope, prioritize areas for inspection, and to review earlier CCTV work and conditions found. [See above]
- Still to be reviewed – D Street - level indication at the station for the wet well, ocean level monitoring, and possible 2nd submersible pump installation or repair of the existing Crane-Demming pump. The electrical service as it is currently installed, prevents for easy removal of the building roof. Will be looking to obtain quote[s] for re-routing the electrical service.

April 2017

- Safety Audit list 96+% completed with only (5) of the original 253 items remaining as of 5/10/17.
- Continue working on procedures for mechanical work in the pump stations and to finalize a plan for a pump base repair at Station 3. The Hull Fire Department contacted to discuss welding operations and safe repair practices.
- There were no odor complaint calls in April.

- There was one SSO event in April 4/1/17 – at the wastewater facility. A rain event and ocean storm surge caused inflow and infiltration to the Hull sewer system that increased flows to the facility which exceeded peak design of 8.0 MGD. The high storm tide levels/surge caused the capacity of the gravity outfall to decrease below the actual effluent flow pumped to the chlorine contact tanks during the high tide. Disinfected wastewater overflowed from the chlorine contact tanks onto the adjacent ground surface and nearby catch basins. A sanitary system overflow [SSO] notification was made on 4/1/17 to the EPA, MADEP, and all regulatory agencies, with a full report submitted on 4/6/17.
- The rain event on 4/1/17 caused for high flows to pump stations A, 3 & 9 and additional pump trucks were called in to assist with pumping of wet wells. There were no reported back-ups, as a result of the high station wet wells. The facility was staffed throughout the entire period until flows decreased to manageable levels. All excess plant tankage was placed into service.
- Onsite Technical support from Woodard & Curran staff member Kristina Richard on 4/20/17 to review the products/items planned for disposal, walk-through to review container labeling, and to ensure proper handling of “universal waste,” waste oil, and old fluorescent lamp ballasts.
- Plant flow meters – Influent, Effluent, and Station 3 checked and calibrated by True North Systems, Inc.
- Semi-annual fire alarm testing completed by Automatic Alarm. Subsequent trouble conditions with horn-strobe circuit. Contacted alarm company for service.
- Pump Station 4 - isolation valves replacement work still on hold until confined space work plan and JSA completed. Internal meetings with corporate H&S department to develop the JSA for the tasks to be performed.
- Pump station #3 - No. 2 pump that has been sent out for repairs. Parts in transit to pump repair shop. Pump base is in poor condition [rotted legs]. Evaluating plan to repair in place due to other corroded components in the pump room. Consulted the Hull Fire Dept. [Steven Johnson] on the hot work permit issues. The 6-inch trash pump is still parked at the station for back-up in the event needed.
- Hoadley vactor truck in on Saturday 4/29 for Spring Street blockage.
- Planned storm coverage for March 31 – April 1 event with staff coverage and equipment placement. Actual conditions were worse than initially forecast, with higher precipitation amounts. Additional staff assistance to the Hull staff provided by W&C's Boston Water & Sewer, UConn and Pinehills projects, the O&M team, and project management team – Frank C. and Rob S.
- Staff coverage split for 4/6-7/17 rain event with round-the-clock coverage. Run D-Street trash pump as needed.
- Additional plant monitoring & D Street trash pump operation on 4/26, due to rainfall.
- WindRiver to set up for continued sewer line cleaning and CCTV inspections. The night-time work was scheduled for the main interceptor, but due to debris and other obstructions, only a limited amount of footage completed and cleaned. Condition assessment, however, indicated interceptor condition was poor. WindRiver to provide all video and reports.
- Godwin & Emergency Bypass Contingencies: Currently a layout and design for the permanent location of the Godwin pump is being worked on. In addition, a temporary plan for the Godwin pump is underway to use the pump has a headworks bypass to conduct multiple repair / construction projects inside the headworks. Quotes have been requested from bypass contractors to purchase HDPE piping for this headworks bypass use. Additional emergency contractor support for bypassing at all pump stations and plants is being evaluated with Godwin, United Rentals and Baker.
- Jason Kreil a technical manager out of our Dedham MA, office started further evaluating the Godwin pump permanent location including hydraulic calculations.
- Influent Gate Design – 3 Different Vendors were requested to provide quotes and drawings for review based on headworks drawings and site tours. All 3 quotes have been received and reviewed for recommendation. W&C also met with multiple contractors on the installation and additional review of gate selection for best mounting installation options. Final details were implemented into the

recommendation plan and discussed with the Town for a final recommendation and installation plan to be submitted in May.

- Alan Fabiano – returned the GPS locator with upgraded software and set-up with tablet for easier field use. Currently evaluating the GPS unit's Z elevation accuracy and working with Jake Needle from our GIS department.
- * Continued discussions between the Sewer Department, W&C, and phone system provider to review emergency notification procedures during weekends and off hours. Goal is to have a more consistent “call tree” procedure and possibly eliminating the on-call pager.
- * Continued assistance on the AOC-CMOM with Town and regulatory agencies. Completed the CMOM Annual Report, NPDES I/I Report Requirements for 2015 & 2016, Set up Asset Management Software transition, and Reorganized important record information management

2 FLOWS AND LOADINGS



Average Annual Flows and Loadings

Contract Year	Eff Flow MGD	Inf Flow MGD	Inf BOD LBS	Inf TSS LBS	Eff BOD LBS	EFF TSS LBS
Year 1	1.547	1.628	2686	4717	79	188
Year 2	1.522	1.635	2410	4042	89	223

2.1 FLOW AND LOADINGS - CONTRACT YEAR (1) 5/2015 TO 4/2016

Month Year	Eff Flow MGD	Inf Flow MGD	Inf BOD LBS	Inf TSS LBS	Eff BOD LBS	EFF TSS LBS
May '15	1.279	*	2,701	3,865	46	170
Jun '15	1.435	*	2,523	2,947	58	143
Jul '15	1.664	1.801	3,873	3,589	81	170
Aug '15	1.415	1.379	2,600	4,410	169	172
Sep '15	1.366	1.506	2,598	2,767	41	143
Oct '15	1.455	1.549	2,623	5,366	91	225
Nov '15	1.359	1.386	2,714	5,417	62	212
Dec '15	1.478	1.479	2,503	5,535	65	152
Jan '16	1.745	1.641	2,119	3,794	70	167
Feb '16	2.030	2.115	2,756	9,082	95	291
Mar '16	1.639	1.674	3,138	5,770	72	223
Apr '16	1.698	1.754	2,081	4,067	96	183
Minimum	1.279	1.379	2081	2767	41	143
Maximum	2.03	2.115	3873	9082	169	291
Total	18.563	16.284	32229	56609	946	2251
Average	1.547**	1.628**	2686	4717	79	188

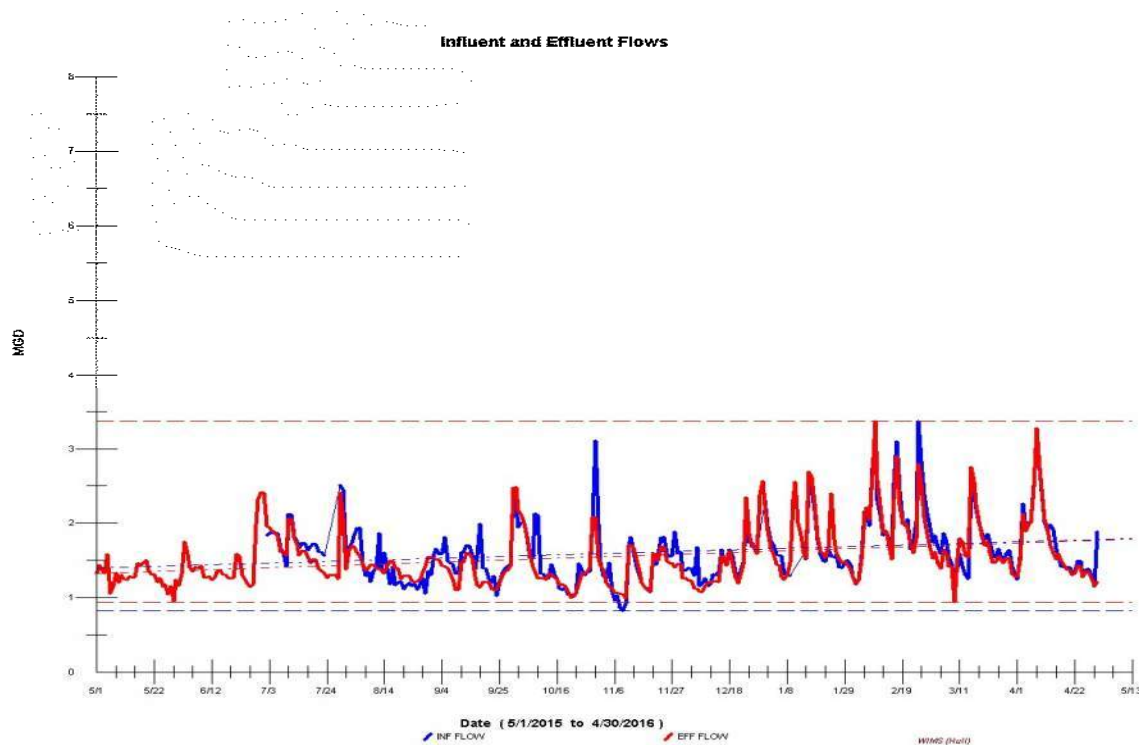
2.2 FLOW AND LOADINGS - CONTRACT YEAR (2) 5/2016 TO 4/2017

Month Year	Eff Flow MGD	Inf Flow MGD	Inf BOD LBS	Inf TSS LBS	Eff BOD LBS	EFF TSS LBS
May '16	1.355	1.348	1,856	3,424	57	146
Jun '16	1.304	1.382	1,767	3,776	99	191
Jul '16	1.281	1.282	3,058	5,291	93	156
Aug '16	1.213	1.224	2,678	5,380	48	170
Sep '16	1.184	1.242	2,749	4,386	90	281
Oct '16	1.398	1.546	2,754	3,044	115	198
Nov '16	1.269	1.538	2,977	4,407	115	204
Dec '16	1.347	1.614	2,073	3,790	77	200
Jan '17	1.967	2.295	1,664	4,324	170	410
Feb '17	1.908	1.981	2,324	3,181	82	273
Mar '17	1.579	1.485	3,296	3,845	48	225
Apr '17	2.456	2.684	1,724	3,653	79	217
Minimum	1.184	1.224	1664	3044	48	146
Maximum	2.456	2.684	3296	5380	170	410
Total	18.261	19.621	28920	48501	1073	2671
Average	1.522**	1.635**	2410	4042	89	223

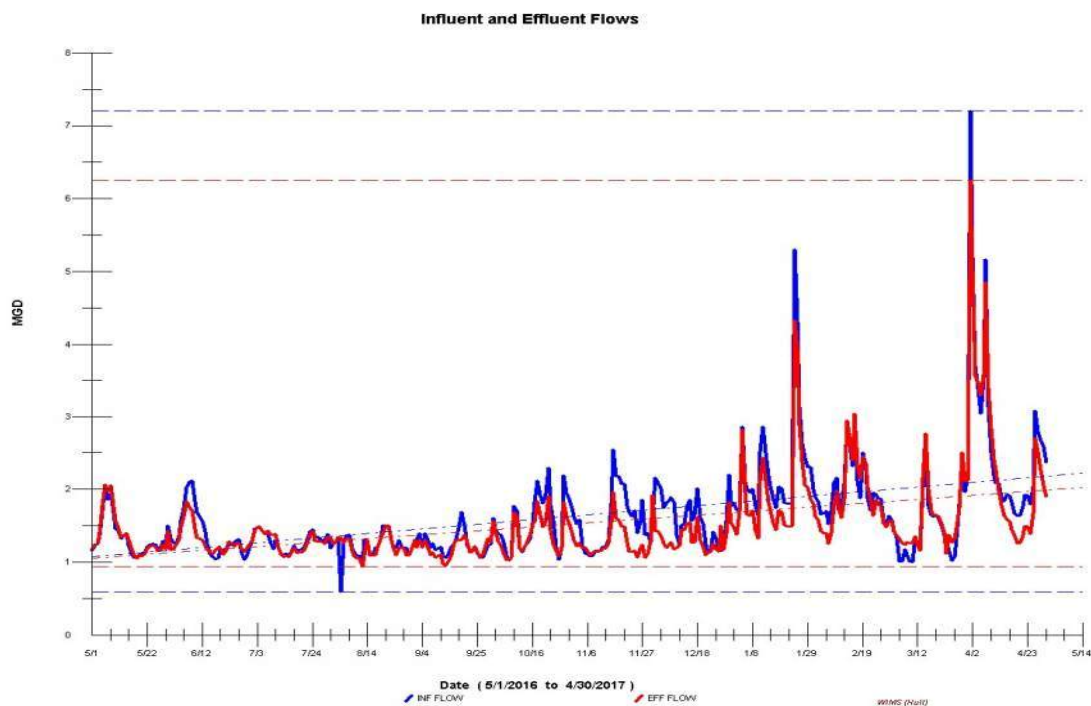
* Influent flow meter not working accurately - system repaired by July

** Influent flow typically higher than effluent flow due to in-plant recycle flows

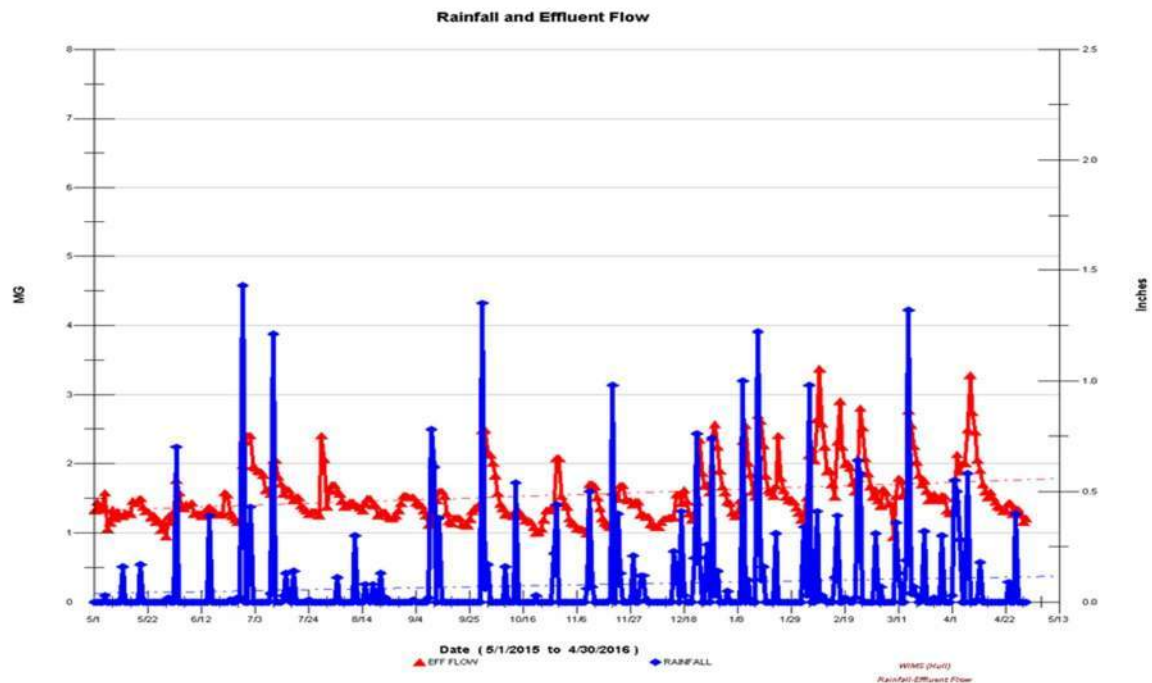
2.3 INFLUENT AND EFFLUENT - AVERAGE DAILY FLOWS FOR 2 YEARS



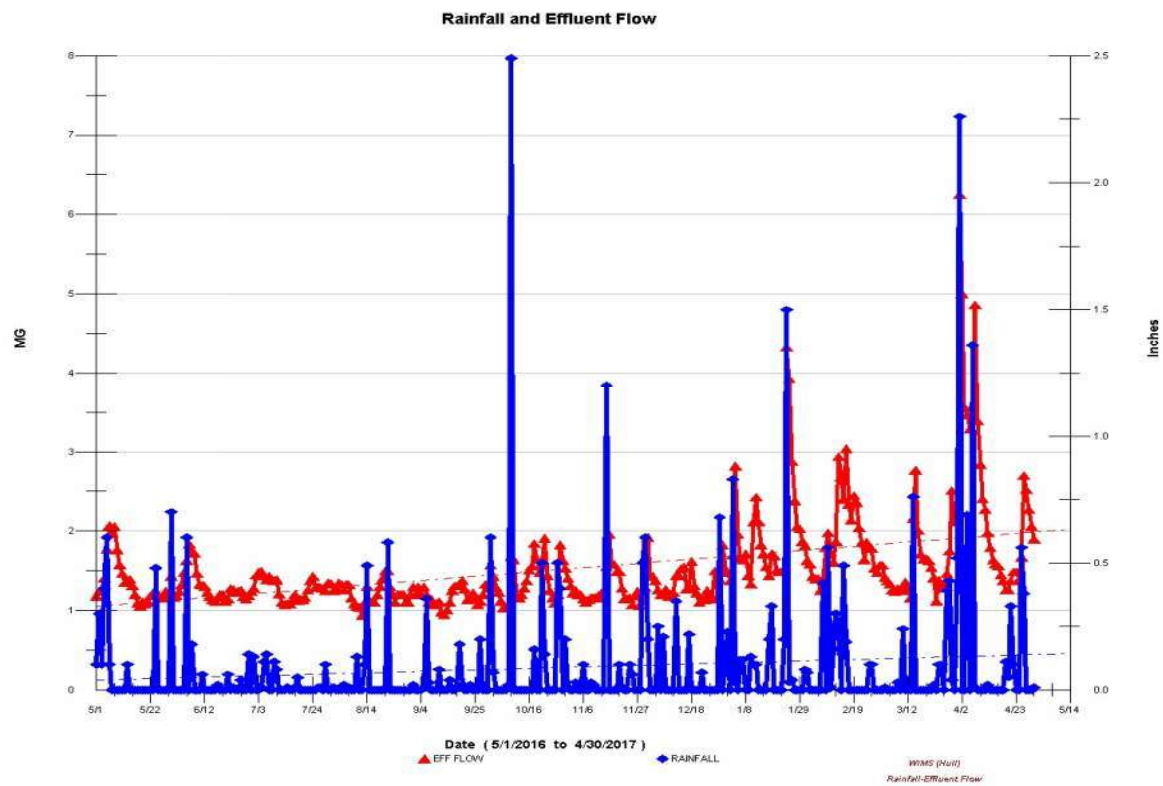
INFLUENT AND EFFLUENT PEAK DAILY FLOWS FOR 2 YEARS



2.4 RAINFALL AND EFFLUENT FLOWS



AVERAGE DAILY EFFLUENT FLOW VS RAINFALL



PEAK DAILY EFFLUENT FLOW VS RAINFALL

3 WATER QUALITY



Staff did an exceptionally good job during the first two operating years of the contract in regards to the effluent and water quality discharged from the Hull Wastewater Treatment Facility.

With all the transitional work, maintenance, repairs and system restoration there was only one occurrence during the 3343 samples that did not meet the NPDES Permit limits.

The final effluent BOD for the composite sample collected on 8/19/15 had a reported result of 53 mg/L which exceeded the maximum daily limit of 50 mg/L. On the sample collection day staff were completing the take down of one of the final clarifiers for annual inspection and service and cleaning out one of the off-line aeration tanks. The added hydraulic and solids loading on the system was the probable cause for the reduction in treatment efficiency. A change in tank cleaning and dewatering strategy was discussed and will be implemented for future work, to minimize the loading impact on the system.

PERMIT LIMITS – BOD MAX DAILY - 50 mg/L. ACTUAL RESULTS – MAX DAILY – 53 mg/L
BOD AVG WEEKLY - 45 mg/L AVG WEEKLY – 53 mg/L

3.1 KEY PERFORMANCE INDICATOR REPORTS (KPI)

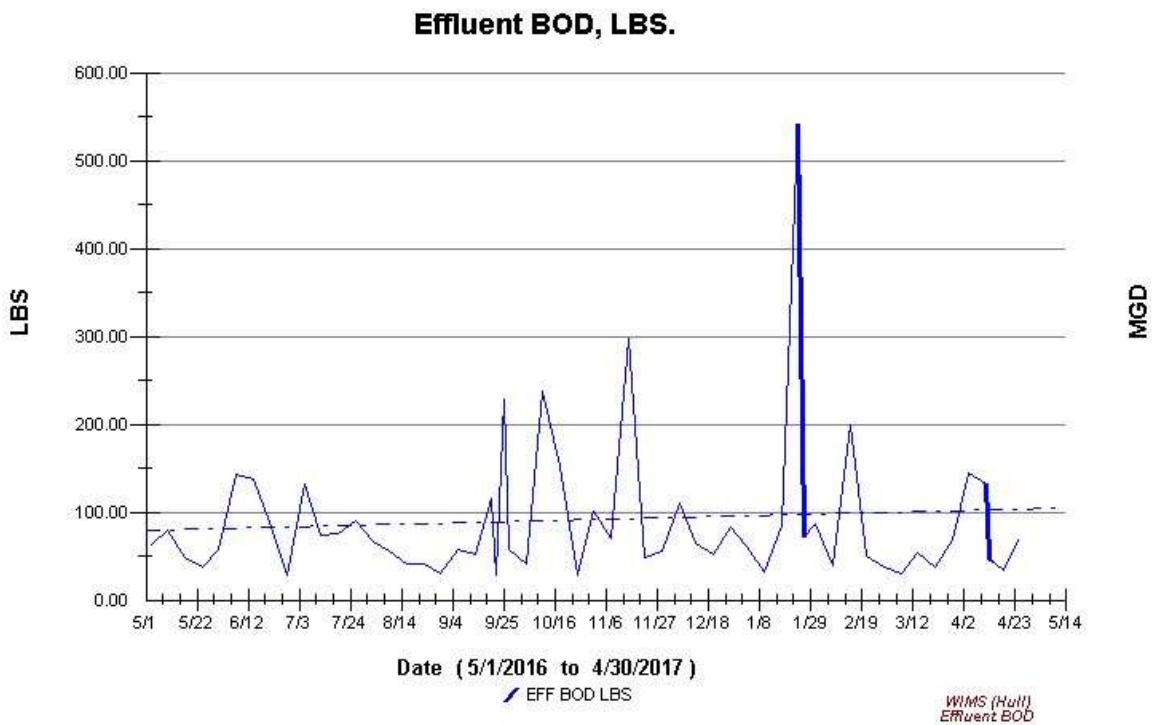
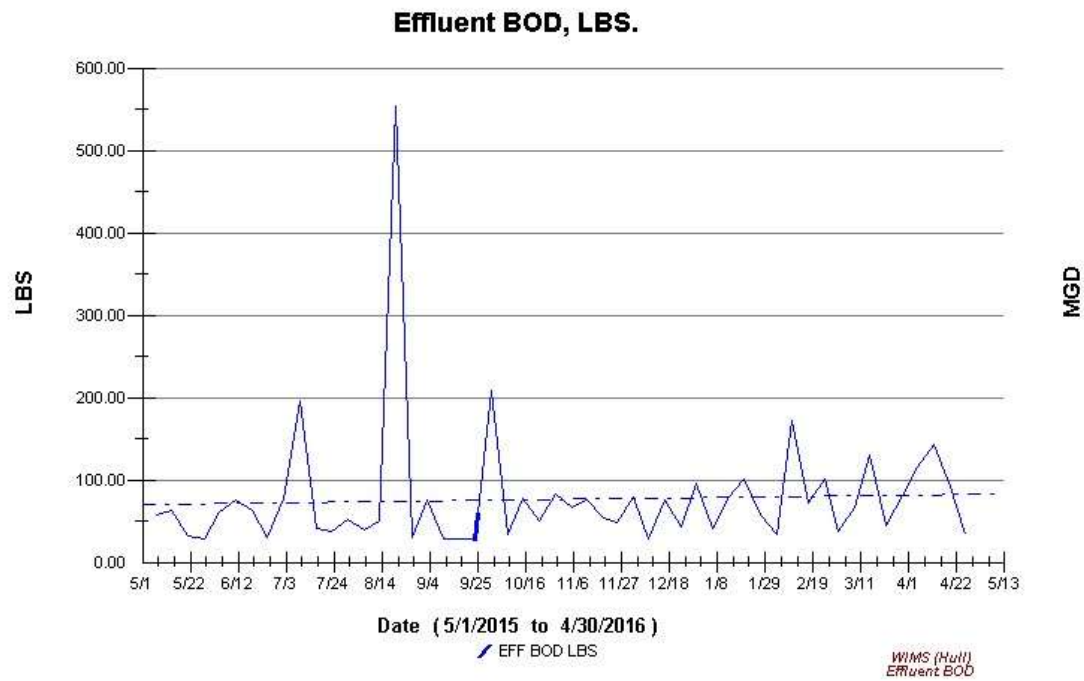
May 2015 to April 2016

Parameter Info		Permit Requirements					Results				
Parameter	Units	Daily Max	Daily Min	Weekly Avg Max	Monthly Avg Max	Freq	Period Avg	Period Min	Period Max	# of Samples	# of Violations
Eff TSS	MG/L	50		45	30	1 X Week	14.4	6.0	26.0	55	0
Eff TSS	LBS			1152	768	1 X Week	185.6	55.4	537.5		0
% TSS Rem	%		85			1 X Month	95.2				0
Eff BOD	MG/L	50		45	30	1 X Week	6.1	3.0	53.0	54	1
Eff BOD	LBS			1152	768	1 X Week	77.3	27.7	554.7		0
% BOD Rem	%		85			1 X Month	93.1				0
Eff Chlorine	MG/L	1			0.7	3 X Day	0.15	0.00	0.69	1,098	0
Eff Fecal	#/100 ML	260			88	1 X Week	10.0	10.0	10.0	52	0
Eff pH	SU	8.5	6.5			1X Daily	6.8	6.5	7.2	366	0
Enterococci	#/100 ML	276			35	1 X Week	10	10	20	52	0

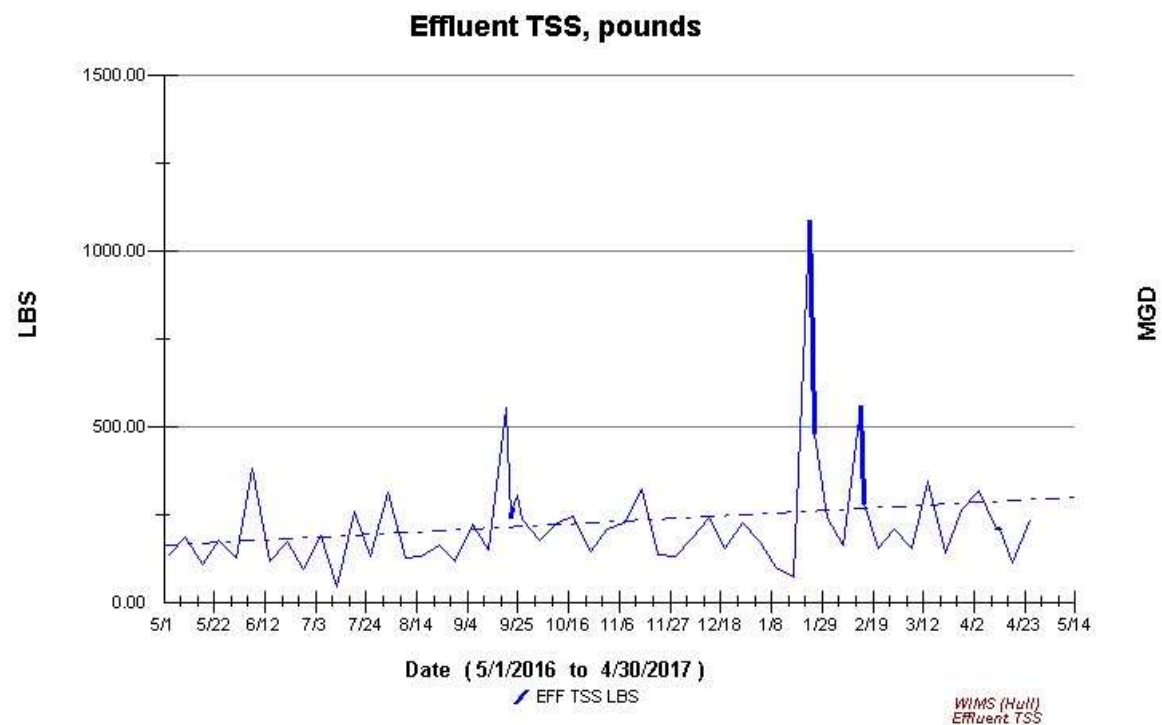
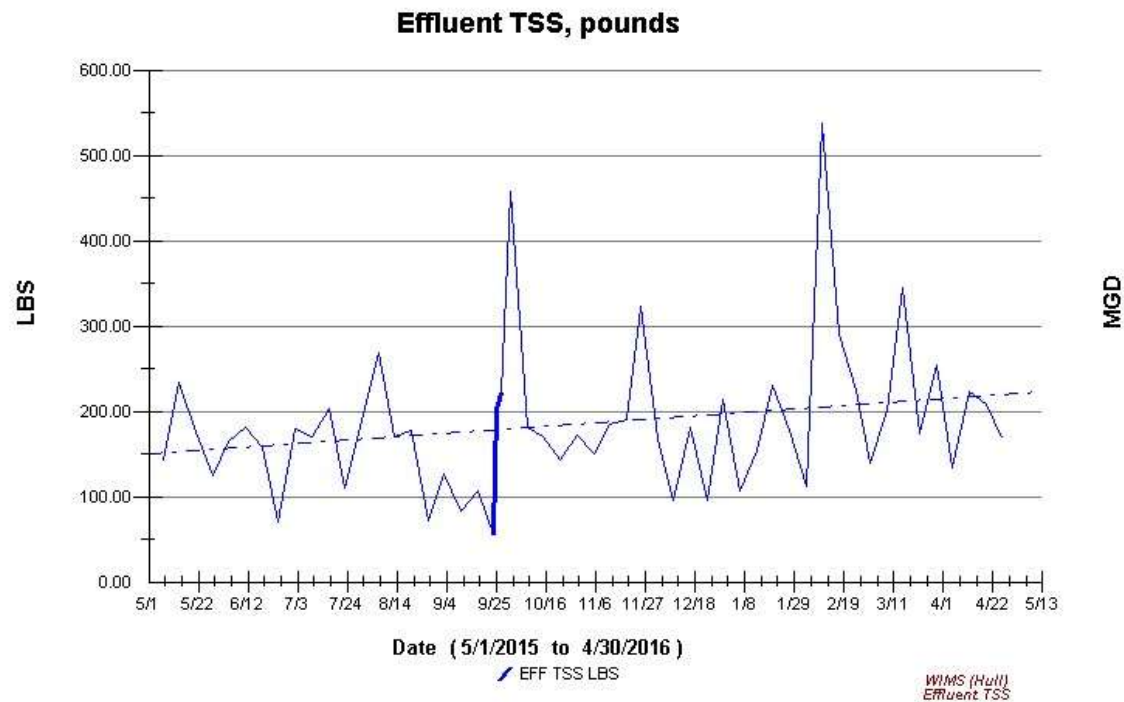
May 2016 to April 2017

Parameter Info		Permit Requirements					Results				
Parameter	Units	Daily Max	Daily Min	Weekly Avg Max	Monthly Avg Max	Freq	Period Avg	Period Min	Period Max	# of Samples	# of Violations
Eff TSS	MG/L	50		45	30	1 X Week	17.5	5.0	48.0	60	0
Eff TSS	LBS			1152	768	1 X Week	233.0	46.0	1,083.4		0
% TSS Rem	%		85			1 X Month	92.2				0
Eff BOD	MG/L	50		45	30	1 X Week	7.3	3.0	24.0	52	0
Eff BOD	LBS			1152	768	1 X Week	94.0	28.5	541.7		0
% BOD Rem	%		85			1 X Month	92.6				0
Eff Chlorine	MG/L	1			0.7	3 X Day	0.12	0.00	0.71	1,095	0
Eff Fecal	#/100 ML	260			88	1 X Week	14.7	10.0	200.0	52	0
Eff pH	SU	8.5	6.5			1X Daily	7.0	6.5	8.1	365	0
Enterococci	#/100 ML	276			35	1 X Week	10	10	20	52	0

3.2 EFFLUENT BIOCHEMICAL OXYGEN DEMAND (BOD) LBS.



3.3 EFFLUENT TOTAL SUSPENDED SOLIDS (TSS) LBS.



4 OPERATIONS

4.1 EFFLUENT TREATED (MG) VS SLUDGE DISPOSAL (GALS)

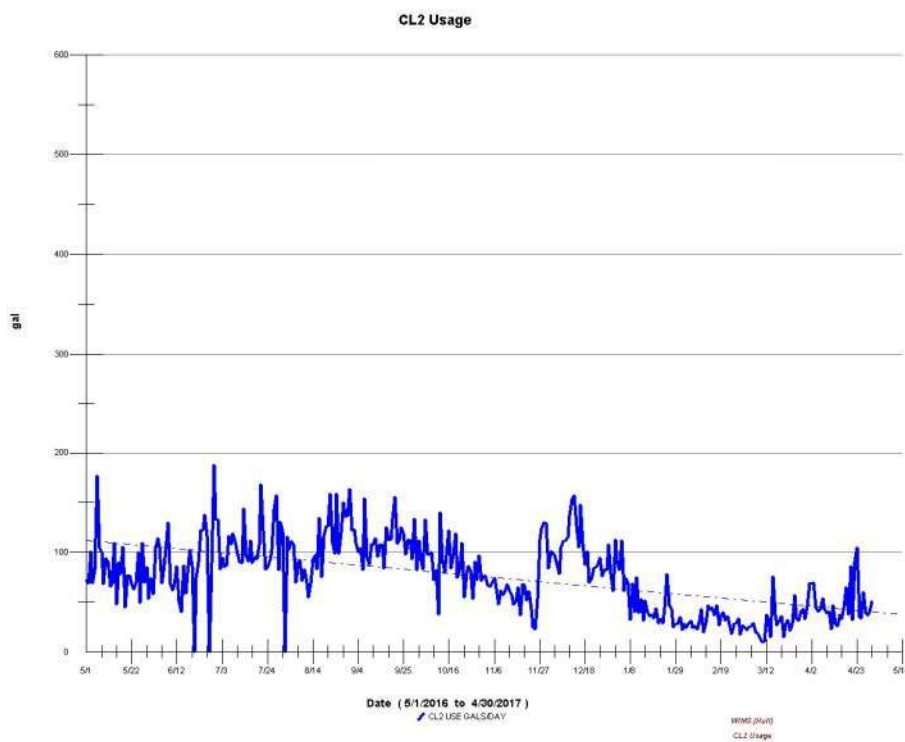
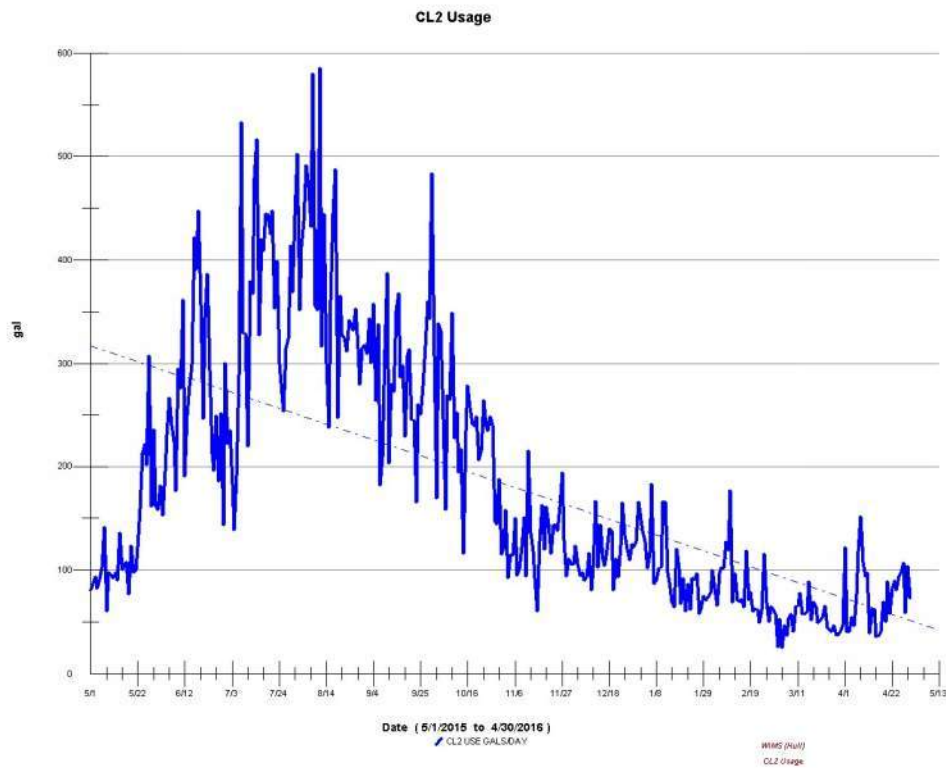
Month Year	Effluent MG per Month	Sludge Disposal Gallons
May '15	39.65	170,500
Jun '15	43.06	144,000
Jul '15	51.57	135,000
Aug '15	43.87	117,000
Sep '15	40.97	126,000
Oct '15	45.12	108,000
Nov '15	40.78	72,000
Dec '15	45.82	117,000
Jan '16	54.10	135,000
Feb '16	58.88	117,000
Mar '16	50.82	117,000
Apr '16	50.93	90,000
Total	565.56	1,448,500
Minimum	39.65	72,000
Maximum	58.88	170,500

Month Year	Effluent MG per Month	Sludge Disposal MGD
May '16	42.01	90,000
Jun '16	39.11	90,000
Jul '16	39.72	90,000
Aug '16	37.62	90,000
Sep '16	35.52	53,500
Oct '16	43.34	63,000
Nov '16	38.08	90,000
Dec '16	41.75	117,000
Jan '16	60.99	126,000
Feb '16	53.43	117,000
Mar '16	48.94	126,000
Apr '16	73.67	144,000
Total	554.18	1,196,500
Minimum	35.52	53,500
Maximum	73.67	144,000

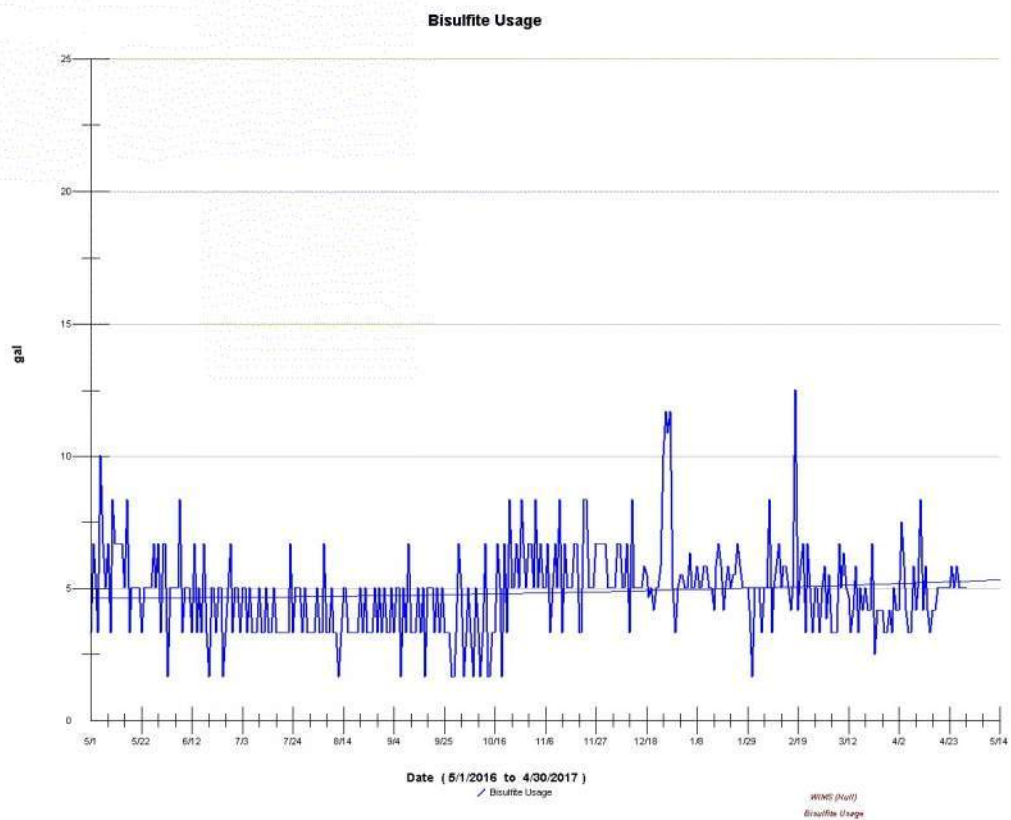
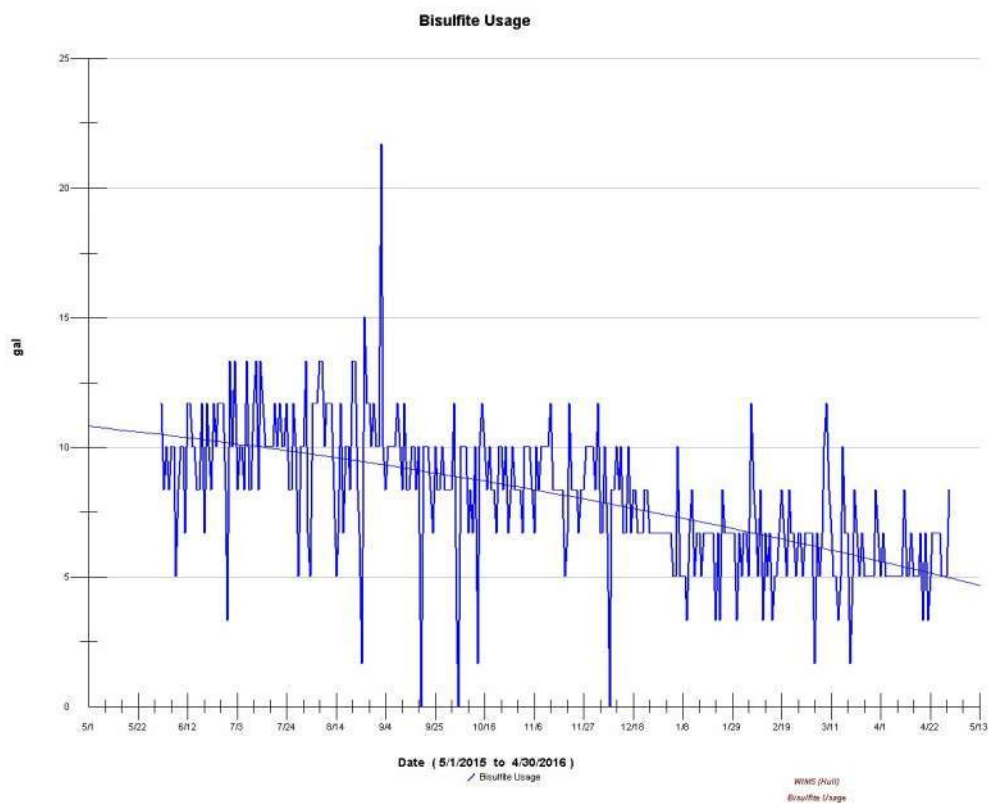
The sludge generation averaged 2,561 lbs/MG in 2015 and 2,159 lbs/MG in 2016, a 15.7 % reduction. This is attributed to the In-Pipe bacteria addition and the wet well aeration, along with ongoing activated sludge process management.

4.2 CHEMICAL USAGE

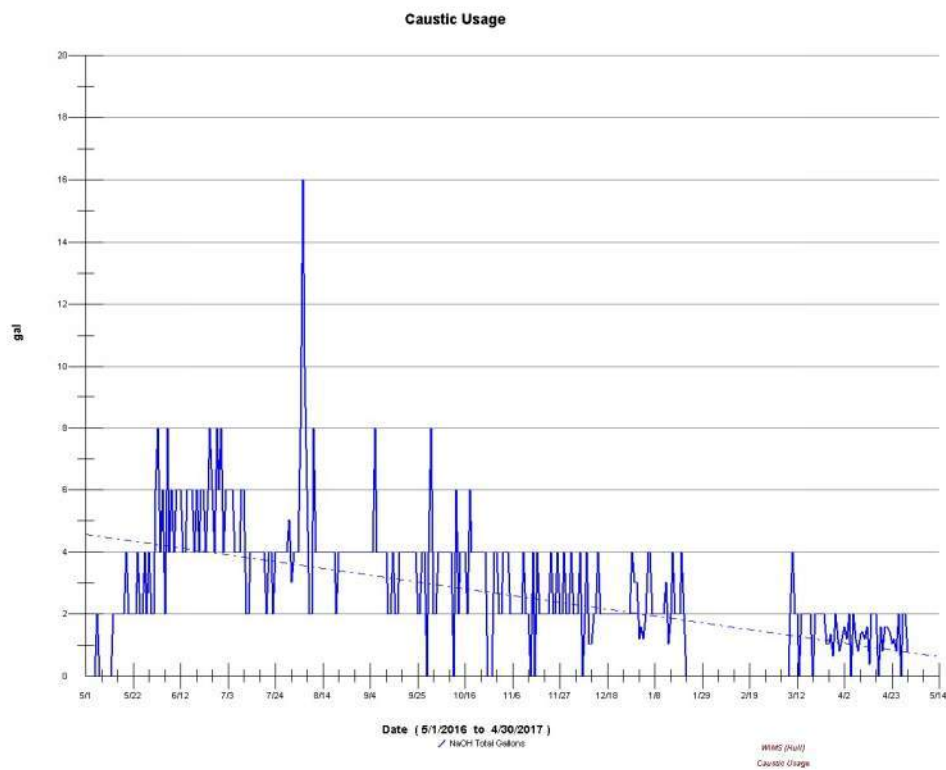
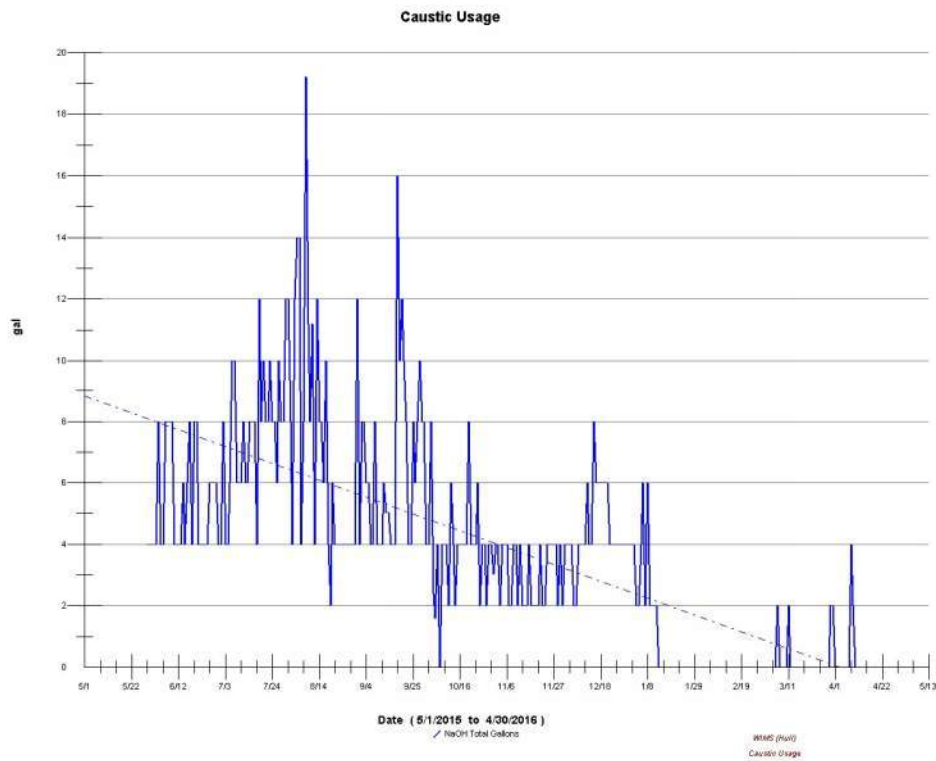
4.2.1 Sodium Hypochlorite



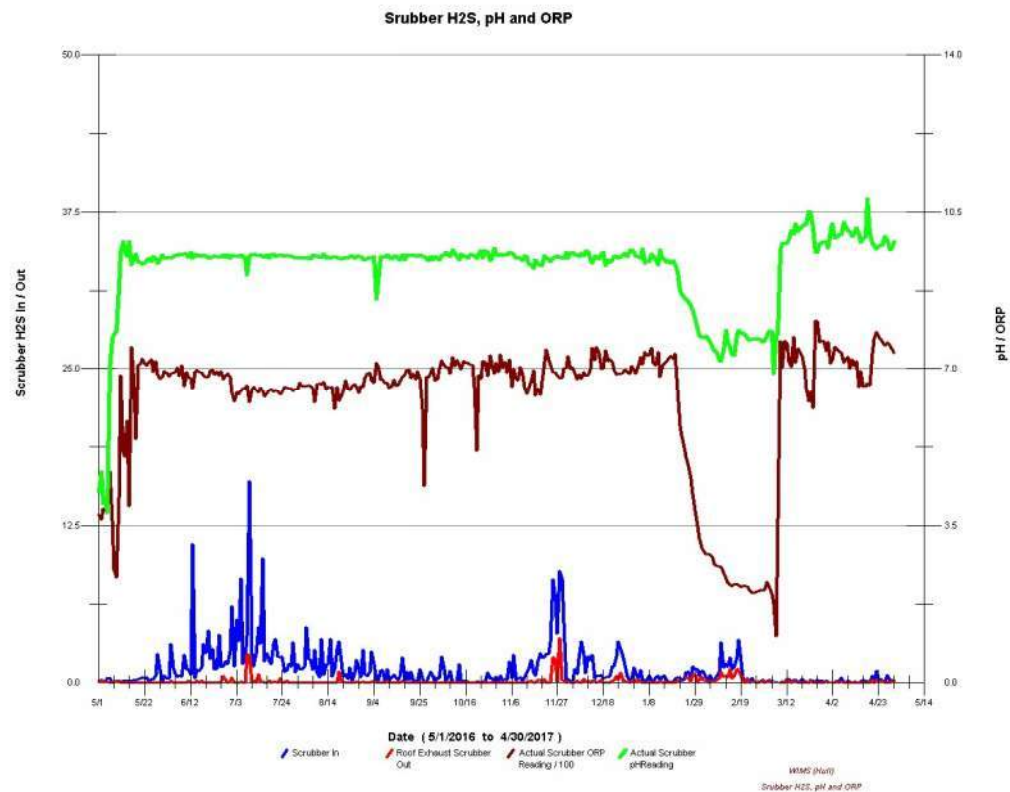
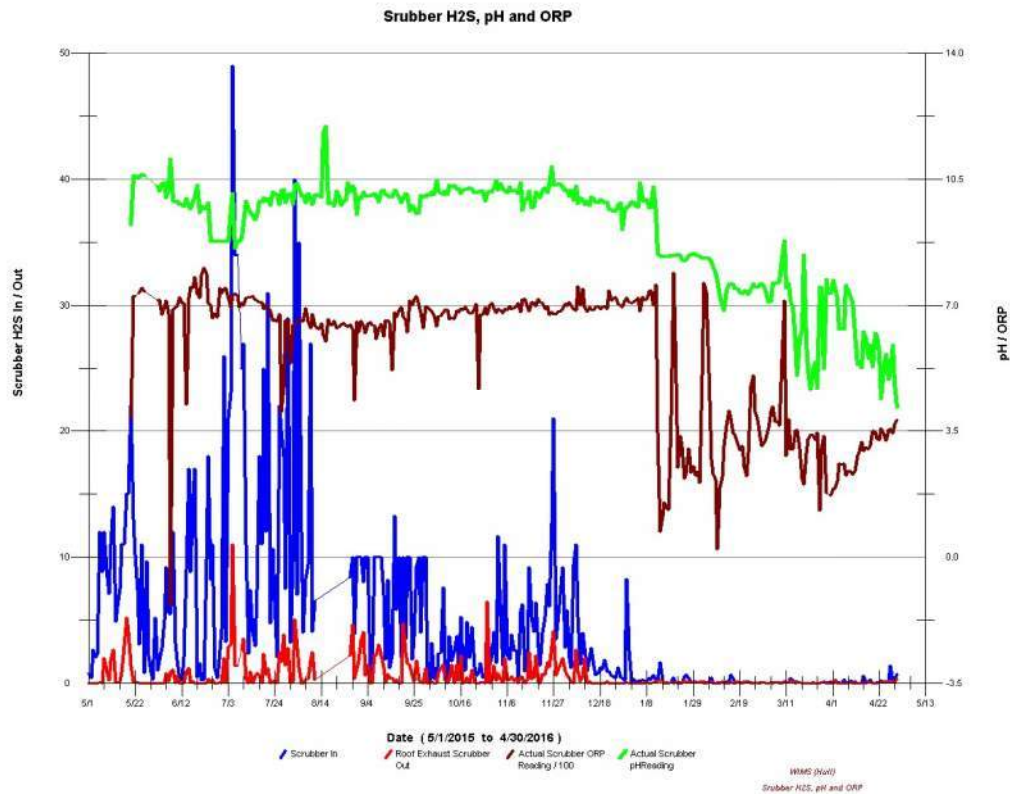
4.2.2 Sodium Bisulfite



4.2.3 Sodium Hydroxide



4.3 ODOR CONTROL



5 MAINTENANCE SUMMARY

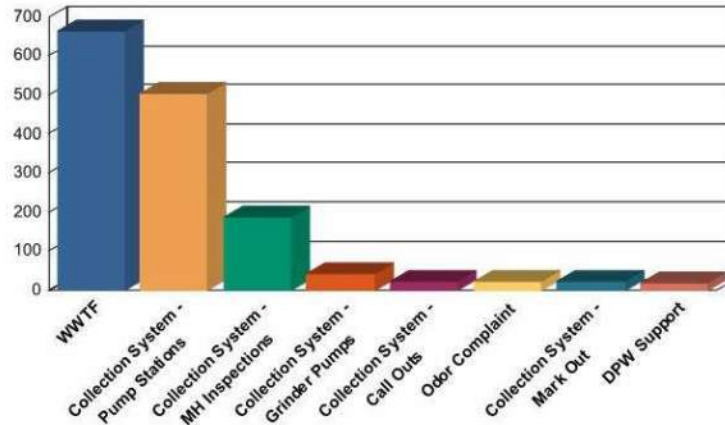


Hull Wastewater Treatment Facility and Collection System Maintenance History Report Year 1

Start Date: 5/1/2015
End Date: 4/30/2016

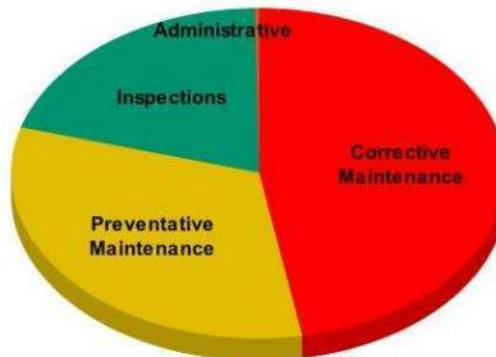
Work Order History by Department

	Totals
WWTF	665
Collection System - Pump Stations	505
Collection System - MH Inspections	187
Collection System - Grinder Pumps	43
Collection System - Call Outs	23
Odor Complaint	23
Collection System - Mark Out	23
DPW Support	19
Grand Total	1,488



Work Order History by Category

	Totals
Preventative Maintenance	32.0%
Corrective Maintenance	47.2%
Inspections	20.3%
Administrative	0.3%
Emergency Repair	0.2%
	100.00%



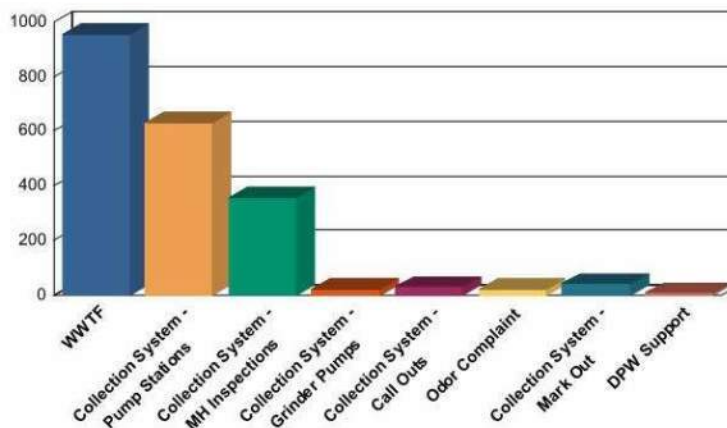


Hull Wastewater Treatment Facility and Collection System Maintenance History Report Year 2

Start Date: 5/1/2016
End Date: 4/30/2017

Work Order History by Department

	Totals
WWTF	954
Collection System - Pump Stations	630
Collection System - MH Inspections	359
Collection System - Grinder Pumps	23
Collection System - Call Outs	32
Odor Complaint	21
Collection System - Mark Out	43
DPW Support	8
Grand Total	2,070



Work Order History by Category

	Totals
Preventative Maintenance	45.4%
Corrective Maintenance	35.7%
Inspections	18.6%
Administrative	0.1%
Emergency Repair	0.1%
	100.00%



6 SAFETY



It is Woodard & Curran's policy to maintain a safe and healthy work environment for every employee and to comply with applicable occupational health and safety regulations. Woodard & Curran's Project Safety Planning Program (PSPP) establishes a project planning framework to identify and correct workplace hazards.

In the cost proposal for Contract Operations at the Hull Wastewater Treatment Facility it was noted that the most significant transitional cost would be the need to address outstanding health and safety issues at both the pumping stations and the treatment facility.

A detailed listing of the safety deficiencies discovered during the initial site visits was provided to the Town of Hull as well as recommendations for correcting these issues.

In April, 2015 Woodard & Curran's Corporate Health and Safety Staff conducted a detailed Occupational Health and Safety review of the site and compiled a report which detailed the findings and produced an audit listing over 250 items (largest to date) needing to be addressed.

A transitional safety budget of \$169,750 was established by the Town of Hull to address these safety concerns.

Correction of these safety related issues noted on the audit list was considered an ongoing priority until completed.

The Town of Hull was provided an updated monthly status report of the corrective actions that was included in the Monthly Operating Report and provided to the Hull Permanent Sewer Commission.

With the assistance of Woodard & Curran's Corporate Health and Safety Department, Technical Support, and a dedicated Plant Staff the audit was reduced to (5) remaining items to be addressed as of May 10, 2017.

7 STAFF DEVELOPMENT

Training is an important part of any operation to ensure employee health and safety is assured, quality standards are maintained, staff skills are improved, career opportunities become available, and higher productivity is achieved.

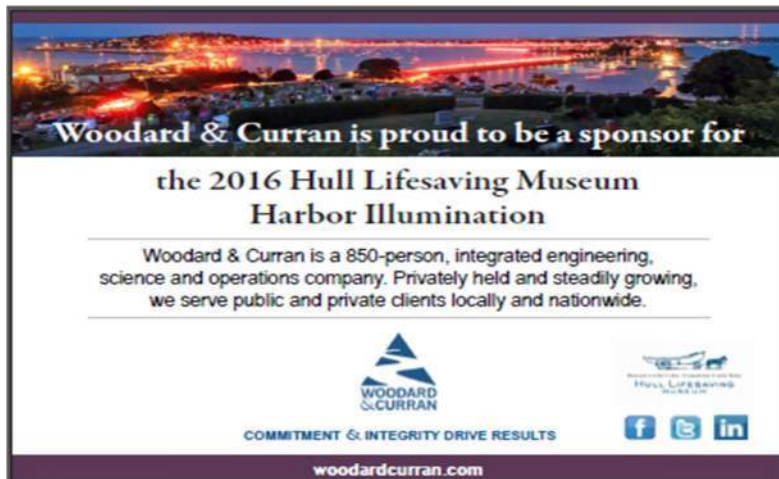
Listed is a general outline of training that the staff received over the first two years of the contract. (Not fully inclusive but provides a good summary of the staff development.)

Training Title	05/15 to 04/16	Start Date
Electrical Safety and Lockout/Tagout		05-08-2015
Woodard & Curran - How to Identify a Confined Space, Video Presentation		05-08-2015
Woodard & Curran - Marlborough Incident, Video Presentation		05-08-2015
Woodard and Curran - 2012 NFPA 70E: Electrical Safety in the Workplace		05-15-2015
Preventing Back Injury		06-01-2015
Electrical Qualification Training		06-11-2015
July Safety Training - Heat Stroke		07-01-2015
CPR & First Aid Training		07-01-2015
Cleaning Up Small Chemical Spills		08-01-2015
Hearing Conservation		09-01-2015
October Safety Training		10-01-2015
Hazard Communication		11-01-2015
Woodard & Curran Bloodborne Pathogen		01-01-2016
Hand, Wrist and Finger Safety		01-04-2016
February Safety Training - Proper Inspections for Wire Ropes used in Hoists		02-01-2016
Forklift and Crane Survey		02-08-2016
Machine Guarding		03-01-2016
Three Dimensions of Safe Driving - Small Vehicle		04-04-2016
Harassment in the Workplace		04-18-2016
Training Title	05/16 to 04/17	Start Date
May 2016 Safety Training		05-02-2016
Guarding Floor and Wall Openings and Holes		05-31-2016
1B Massachusetts Hoisting License		06-03-2016
July Safety Training		07-01-2016
Ladder Safety		08-01-2016
Hearing Conservation		09-01-2016
Hazard Communication		10-03-2016
Forklift Operator Performance Evaluation		10-19-2016
WHAT IF? Mentality		11-01-2016
Woodard & Curran Bloodborne Pathogen		01-01-2017
Personal Protective Equipment (PPE) Part Two		01-04-2017
Recognizing Electrical Hazards		02-01-2017
Preventing Back Injury		03-01-2017
Industrial Ergonomics v2		04-01-2017

8 COMMUNITY INVOLVEMENT & CLIENT RELATIONS

8.1 HARBOR ILLUMINATION SPONSORSHIP PROGRAM

The Illuminated Boat Parade is perhaps the single most visible and enjoyed annual event in the Town of Hull. Woodard & Curran was pleased to participate at a sponsorship level that proudly reflects our firm's commitment to the Hull community!



8.2 INTERNSHIPS

Woodard & Curran offers opportunities for internships for both high school and college students who have an interest in wastewater operations. Interns are given the opportunity to work hands-on with skilled operators and technicians to participate as a valued team member supporting daily operations such as water sampling, lab testing, data analysis, report generation, equipment maintenance and grounds maintenance. Students are provided with mentorship, training and challenges to ensure they are receiving the most of each opportunity. In 2015 there was one intern at Hull and in 2016 there were three, one of whom returned from the year prior to complete a second internship.

8.3 HULL WPCF SITE VISIT AND CLIENT MEETING

On 07/28/16 Woodard & Curran's Client Manager Becky Corbin met with the Jim Dow, Town of Hull DPW Superintendent to discuss his views on the Project and the services provided by Woodard & Curran. Mr. Dow was very pleased with the quality of service that has been provided over the first year of the contract. He was also very complimentary of Frank Cavaleri (Area Manager), Aram Varjabedian (Project Manager), and the entire operations team. Their forward thinking, ability to come up with great ideas, and contributions to the Town's strategic planning was praised.

A couple examples of positive results or value added services where:

Odor complaints have dramatically reduced due to implemented operational changes at the plant.

And

Frank Cavaleri's investigation into hydrogen sulfide vulnerabilities identified a potential issue, causing the Town to initiate an emergency repair and head of a potentially much more significant repair.

Mr. Dow said that he would rate the Woodard & Curran Operations Team a 9.99 out of 10 and wished there was another 29 years left on the contract instead of 9.

9 TECHNOLOGY INITIATIVES

Effective communication with our Clients is of paramount importance. Accurate records provide the basis for making operational decisions, troubleshooting, planning, justifying, or supplying evidence of performance with compliance or regulations and establishing a trusting partnership.

Computerized Maintenance Management System – Woodard & Curran has transitioned the utilization of the SEMS Technologies Asset Management software. The SEMS Asset Management system is designed to streamline asset management, labor, parts and material, scheduling, work-orders and tracking resulting in reduced equipment downtime, controlled inventory, lower procurement costs, and complete reporting. The software resides on a centralized server that is maintained by MIS professionals. The data accumulated during maintenance activities is transferred to the server for historical recording and monitoring of equipment. From this database, work orders are generated along with reports that are used to improve the efficiency of the maintenance function.

Woodard & Curran has standardized its data management program by utilizing **Hach Water Information Management Solution (Hach WIMS)**. This industry standard provides the user with secure data management, streamlined reporting, user-defined alerts, and charting and graphing tools that are used for process management and trouble-shooting. The software generates reports for the EPA, state, and other regulatory agencies.

The **doForms** application is extremely versatile application and is used for many field data gathering efforts and it sends data seamlessly back and forth to both our SEMS and HACH WIMS systems, including:

- Creating field work orders, as well as completing work orders dispatched from the SEMS system
- Inputting rounds data and automatically transfers pertinent operational data into the HACH WIMS system
- Capability to email work orders with photos from the field
- many other functions that improve our ability to gather pertinent data and use it effectively

All our staff have **Smart Phones** and the ability to do multiple tasks and improve overall communications, especially under emergency situations.

Extensive **SCADA** system reliability and efficiency improvements are implemented and Managers and key staff can monitor the plant SCADA system remotely.



10 PROJECT MANAGEMENT & ADMINISTRATION



- **High Flow Management Plan drafted in July, 2015 for the Town of Hull Water Pollution Control Facility. This is a living document that will be updated based on lessons learned during the storm events.**
- **Asset inventory and condition assessment to prioritize for capital improvements**
- **Creation of a Fiscal Sustainability Plan for long term stability**
- **Investigation into resiliency adoptions measures utilizing the EPA CREAT Tool**
- **Support services to comply with the Administrative Order of Consent - CMOM**

10.1 COMPLIANCE AND CAPITAL MANAGEMENT

Approximately one year after beginning operations, on May 9, 2016, the Town of Hull entered into an Administrative Order on Consent with EPA, to comply with the Clean Water Act, with the goal of improving collection, management operation and maintenance (CMOM) activities in the Publicly Operated Treatment Works (POTW). As a part of a Task Order addendum to the Operations Contract, Woodard & Curran Engineers provided support with the following deliverables:

1. Unauthorized Discharge Summary, *submitted July 26, 2016*
2. Emergency Response Plan, *submitted August 31, 2016*
3. I/I Control Plan, *submitted August 31, 2016*
4. CMOM Self-Assessment, *submitted October 31, 2016*
5. CMOM Annual Report, *submitted March 31, 2017*

The remaining Administrative Order deliverables will be completed over the following months, and are being coordinated with organization capital asset management activities:

6. CMOM Program Manual, *due June 30, 2017*
7. CMOM Corrective Action Plan, *due July 31, 2017 (per December 21, 2016 extension)*
8. CMOM Annual Report, *due March 31, 2018 and annually until further notice*
9. Third Year CMOM Program Self-Assessment Checklist, *due July 31, 2019*

Concurrently, the Town received an Asset Management and Fiscal Sustainability Planning Grant from MassDEP, to aid in the preparation of a formal Asset Management Program and facilitate the purchase of related software. As a part of a Change Order addendum to the Operations Contract, Woodard & Curran Engineers are in the process of completed a comprehensive report, including risk analysis of current major assets and collection system areas, to aid in the prioritization of capital projects and evaluate the rate structure for future planning needs for the Town of Hull.

APPENDIX B: DRAFT ASSET MANAGEMENT AND FISCAL SUSTAINABILITY PLAN



ASSET MANAGEMENT PLAN

Hull POTW

Appendices Not Included

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Dedham, Massachusetts 02026
800.446.5518

woodardcurran.com
COMMITMENT & INTEGRITY DRIVE RESULTS

217319.00
Town of Hull, MA
June 16, 2017

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Appendix E: Software Evaluation
Appendix F: EPA CREAT Report
Appendix G: Funding Plan Tool

EXECUTIVE SUMMARY

The Town of Hull (Town) is a peninsula community of about 10,000 permanent residents, and 15,000 seasonal residents, located between Hingham Bay and Massachusetts Bay on the South Shore of Massachusetts. The Town's sewer system is comprised of approximately 42 miles of separated gravity sewers, seven sanitary wastewater pumping stations, and over 175 publicly-owned grinder pumps within the low-pressure sewer system, which send flow to the Town's Water Pollution Control Facility (WPCF). The WPCF discharges treated effluent to Massachusetts Bay, regulated under a National Pollutant Discharge Elimination System (NPDES) permit. The WPCF also receives flow from the neighboring towns of Cohasset and Hingham, through a sewer utility Inter-Municipal Agreement (IMA).

Due to Town's unique geography, the collection system resembles a "fish skeleton" instead of a typical "tree" configuration. The back bone of the system is the interceptor, which ranges in size from 30" to 36" and is constructed of reinforced concrete. The main gravity interceptor was installed in late 1970's, and 42% of the interceptor has been rehabilitated with a cured-in-place liner. Most areas of the collection system consist of vitrified clay and asbestos cement pipe, with some older areas of original brick infrastructure (late 1800's) and newer areas of PVC (installed in the 1980's and 90's).

The WPCF was constructed in the late 1970's and received a partial upgrade in 2002. Due to the plant's location, it is extremely vulnerable to coastal flooding, and several storms have impacted operations over the WPCF's lifetime. While partial modifications have been made to alleviate the hazards posed during flooding events (post-Blizzard of 1978 and post- "No Name Storm" of 1991), the most recent devastating facility loss in February 2013 caused over \$6 million dollars in repairs, with minimal changes to existing WPCF layout. In 2016, the Town released its Coastal Climate Change Vulnerability Assessment and Adaptation Study, and the WPCF received the highest consequence of failure score, signifying immediate long-term capital planning needs to be prepared.

On May 1, 2015, Woodard & Curran (W&C) entered a 10-year contract to operate and maintain the treatment and collection system for the Town Sewer Department. As part of ongoing contract operations work, Woodard & Curran has prepared several versions of recommended capital repairs and improvements to the collection system and pump stations, as well as treatment plant equipment and unit process upgrade recommendations.

One year later, on May 1, 2016, the Town entered an Administrative Order on Consent (AOC) with U.S. Environmental Protection Agency (EPA) and MassDEP to address ongoing critical asset repairs and address Sanitary Sewer Overflows (SSO's) within the collection system. The AOC (Docket No. CWA-01-AO-16-09) requires several immediate deliverables, including a Collection Management, Operation and Maintenance (CMOM) Program Manual and Action Plan for the collection system and WPCF.

On February 14, 2017, the Town retained Woodard & Curran (W&C) to execute a Change Order to the Operations and Maintenance contract to provide engineering and support services. The key purpose of this change order was to develop an innovative plan for providing overall engineering and O&M support for many interrelated wastewater utility asset management needs. The key areas covered in this change order include the following:

- Asset Management and Fiscal Sustainability Plan – this Plan
- AOC Deliverable Support
- Resiliency Needs Incorporation
- Critical Asset Repair/Replacement Prioritization
- Ongoing Annual Asset Management Repair and Replacement
- Stormwater Compliance Support

- Community/Stakeholder Support

As reviewed in Section 1, this Asset Management Plan is provided as the deliverable per the “Water Infrastructure Assessment and Planning Grant - Round 3, BRP-2017-02,” as approved by MassDEP. Deliverables for this project consist of:

- Written report to provide methodologies, assumptions and data sources for the initial Risk Analysis, and guidance for tools provided to implement comprehensive, proactive approach to infrastructure funding.
- Introduction and Access to Software Tools:
 - Utility Cloud© web-based software
 - Info Master© Innovyze® desktop-based software
 - Google Sheets™ web-based database
 - Funding Tool, Microsoft Excel-based model provided

It the intent of this report to serve as “step one” for the Town’s implementation process. Understanding that asset management is a cyclical process, the continued integration of performance, redundancy, and resiliency data for each individual asset is mandatory. By constantly improving the basis of asset information, the more accurate the planning tools will become over time. Based upon the sheer size of needed improvements, the Town must make informed decisions and this plan provides asset, capital planning and funding tools to demonstrate consequences to the Town and its rate payers.

Based on initial risk analysis, and understanding the initial draft of risk-based capital project planning, the following table shows an example of the proposed investment schedule over the course of the next ten years.

Capital Planning Year	Fiscal Year Financed	Improvement Type	Estimated Cost
1	2019	SSES, I/I Study, Critical Collection Rehab. and WPCF Replacements	\$8,500,000
2	2020	SSES, WPCF/PS Resiliency and Process Improvements, Ph. 1	\$18,350,000
3	2021	WPCF/Pump Station Improvements, Ph. 2	\$2,050,000
4	2022	Collection Rehabilitation, Ph. 1 and WPCF/PS Improvements, Ph. 3	\$2,150,000
5	2023	WPCF/PS Improvements, Ph. 4	\$1,900,000
6-10	2024-2029	I/I Study Update, Collection Rehab Ph. 2 & 3, PS Ph. 5	\$6,030,000
Total			\$38,980,000

It is expected that this list may change as more information becomes available throughout future iterations of this project. As the Town still needs to finalize the scope of capital upgrades, and determine the funding strategy which best suits their needs and their rate payers, the following recommendations are made as immediate next steps:

- Using Utility Cloud© for vertical assets, and NASSCO-Compliant CCTV providers for horizontal assets, move towards 100% current condition assessment of all POTW systems including:
 - Assessing remaining 40% of WPCF assets
 - Mapping remaining 15% of collection system assets, and
 - Collecting condition assessments on remaining 85% of collection system assets
 - Collecting 100% condition assessment of older force mains

- Collecting additional performance assessments on each pump station
- Determine next steps for setting a resiliency design standard for future upgrades
 - Assess WPCF structural feasibility of adaption measures for the control building
 - Assess WPCF electrical system and backup power systems relocation feasibility
 - Determine appropriate design flood elevations to mitigate risk to at each pump station and at the WPCF (based on electrical and structural feasibility assessments)
- Revise risk analysis to reprioritize priority assets
 - Determine scope of Facilities Plan to set long-term phased projects for inclusion on State Revolving Fund (SRF) Intended Use Plan (IUP)

While the Town is not currently on the CWSRF Intended Use Plan, they intend to apply for SRF funding for the projects identified through this program. Once the SRF application is completed, then a public meeting detailing the asset management plan and initial SRF project work would be presented to the public.

1 INTRODUCTION

On February 14, 2017, the Town of Hull retained Woodard & Curran (W&C) to execute a Change Order to the Operations and Maintenance contract to provide engineering and support services, including preparation of the Asset Management and Fiscal Sustainability Plan deliverables, as approved by MassDEP, as a part of the Asset Management Grant Program. This report fulfills the requirements of the application scope and includes additional Fiscal Planning tools. The table below compares the Application Scope of Work (listed 1 – 6 at left) with the Table of Contents of this report (right column) for quick comparison.

Table 1-1: Application and Executed Scopes of Work

Application Scope of Work (by others)	Executed Scope of Work (this Report)
1. Asset Inventory	Section 2: Asset Inventory
2. Condition Assessment (Asset Evaluation)	Section 3: Risk Management Analysis
3. Identification and priority of Criticality Assets	
4. Development of Priority List of Assets	
5. Development of Secondary List of Assets	
6. Cost & Funding Plan	Section 4: Funding and Capital Improvement Planning
N/A	Section 4.2 Rate Planning Tool and Long Term Funding Plan
Report, AM software development & GIS mapping	Section 5: Implementation Recommendations
N/A	Section 5.3 Energy and Conservation Evaluation
N/A	Appendix E: Software Evaluation
N/A	Appendix F: CREAT Evaluation

As a part of Section 3, preliminary coastal adaptation options for the wastewater treatment facility, pump stations, and the collection system were considered as a part of criticality analysis to incorporate resiliency into planning considerations. The EPA CREAT report (Appendix F), along with the 2016 Town of Hull Vulnerability Assessment, were used to provide capital planning estimates which are incorporated in Section 4. Also in Section 4, WPCF preliminary process alternatives were evaluated to help determine future capital plans, and a comprehensive Rate Evaluation tool demonstrated various rate impacts for a 10-year life cycle period. These Financial Sustainability Planning tools comply with MassDEP's State Revolving Fund (SRF) cost effectiveness and affordability criteria, as the Town is planning to submit a Project Evaluation Form (PEF) later this year for funding consideration. In Section 5, initial results of an energy efficiency self-assessment show future steps to be considered for long-term efficiency improvements to the facility, and for inclusion in SRF planning documents.

2 ASSET INVENTORY

The Town of Hull's Publicly Owned Treatment Works (POTW) is comprised of separated gravity sewers, pump stations, force main, grinder pumps/low-pressure networks to transport approximately 1.7 MG (2017 current average daily wastewater flow) to its Water Pollution Control Facility (WPCF). The WPCF provides treatment of municipal wastewater through screening, grit removal, primary treatment, secondary treatment, sludge thickening and trucking to regional incinerator for disposal, and disinfection. Numerous town assets have been previously inventoried and documented as geographic information system (GIS) files, or as assets in the computerized maintenance management system (CMMS). The existing inventories served as the starting point for this evaluation.

Based on the current GIS, the Town's collection system consists of about 42 miles of separated sanitary sewer pipe. In addition to pipes, there are also approximately 994 manholes and seven pump stations in the system. The Town also owns and maintains approximately 175 grinder pumps and a low-pressure sewer system that services the southern portion of the Town. The gravity collection is separated into 12 sewersheds, subdivided sewer areas that each drain to a single point in the collection system. These sewersheds were studied to quantify I/I in the late 1990s and will be refined as the Town's GIS continues to improve with field data collection efforts.

The WPCF receives all flow from the Town of Hull, as well as flow from Hingham and Cohasset communities. The original WPCF was constructed in 1978 with some upgrades/repairs made in 2002 and 2013. Based on the CMMS database, the WPCF is comprised of over 390 assets for its various processes. In general, it was noted that the existing inventory focused primarily on items which required frequent maintenance, like mechanical systems, and not long term assets, like structural components. As a part of capital planning and budgeting, all assets need to be considered for its eventual end of life.

2.1 WPCF

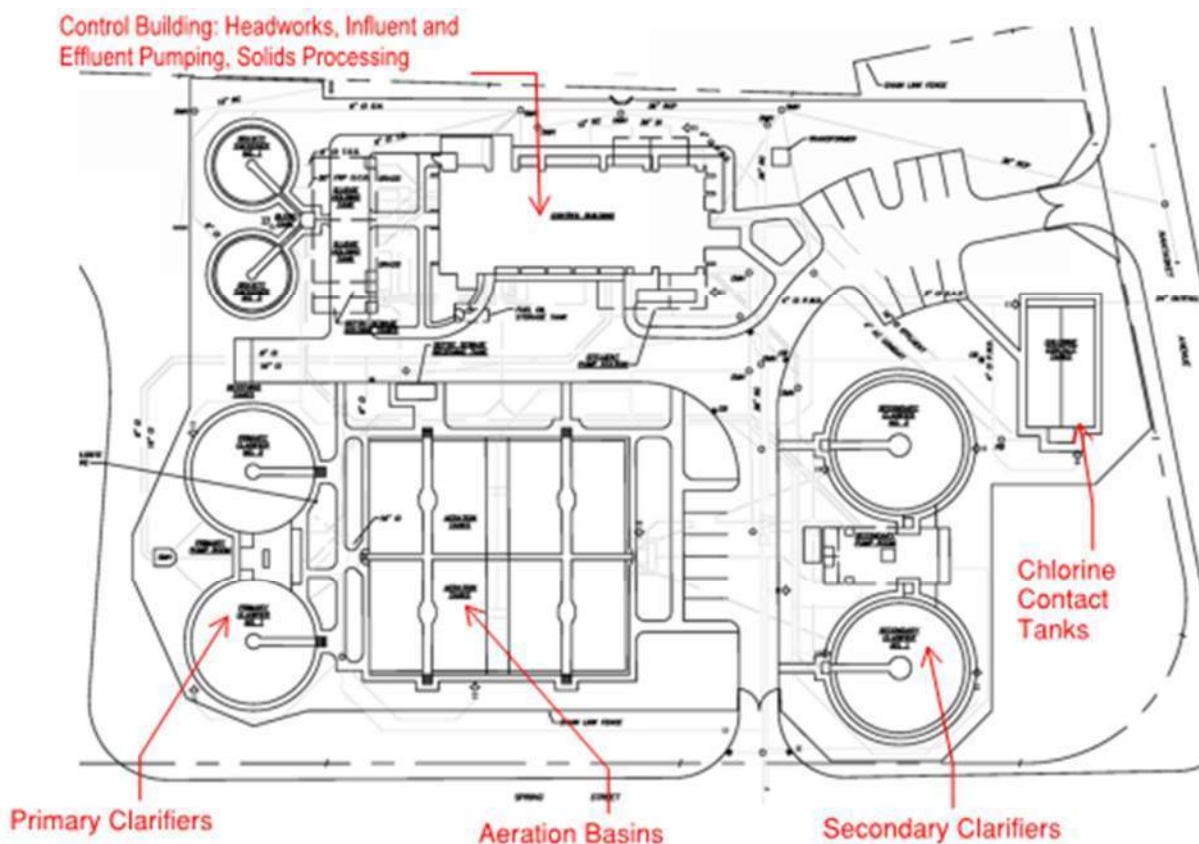
Under the Operations and Maintenance Contract, W&C maintains a WPCF asset inventory in a Computerized Maintenance Management Software (CMMS), SEMS Technologies. The most recent major repair and capital improvement spreadsheet, prepared as a part of the W&C Contract Operations work, was reviewed and combined with the data from the 2014 Tighe & Bond condition assessment spreadsheet and audit forms.

The corrected inventory was imported by SEMS asset number and Parent Category (see descriptions in Figure 2-1), and the following headings were assigned:

- **Utility Cloud ID:** this is the unique identifier assigned by the Utility Cloud software program; for tracking work order tasks and assignments.
- **Asset Description:** this provides the most detail about each individual asset, and is the system descriptor (e.g. "Primary Pump 1" or "Effluent Discharge Check Valve") which typically matches labels and/or equipment tags.
- **Asset ID:** the subset identifier of the Utility Cloud ID, which only counts items contained within the Utility Cloud WPCF group.
- **Category:** the general group or discipline for which the asset is identified as part of: Control, Electrical, HVAC, Lighting, Mechanical, Piping, Pumping, Safety, and Structural.
- **Location:** physical location of the asset within the building, process or site.
- **Type:** the subset identifier of the Parent Group, this field indicates which specific process it impacts through its operation (i.e. Primary Sludge Pumps are responsible for Sludge Handling, the type of process it supports)

The remaining headings capture the condition and likelihood of failure ratings, which will be described in Section 3.1. At the time of this report, over 390 assets have been inventoried within the WPCF, and they are included in Appendix B.

Figure 2-1: WPCF Layout and Major Asset Categories



WPCF Parent Groups
30 - WW Treatment Plant - General
31 - WW Headworks
32 - WW Influent Process
33 - WW Primary Treatment
34 - WW Secondary Treatment
36 - WW Effluent Process
37 - WW Odor Control
38 - WW Disinfection
39 - WW Sludge Treatment

As part of ongoing and future asset management efforts, we plan to continue to inventory assets within the WPCF to a greater level of detail. For the current analysis, we included the building as a single asset. In the future, we will add individual rooms/areas to the asset list, such as:

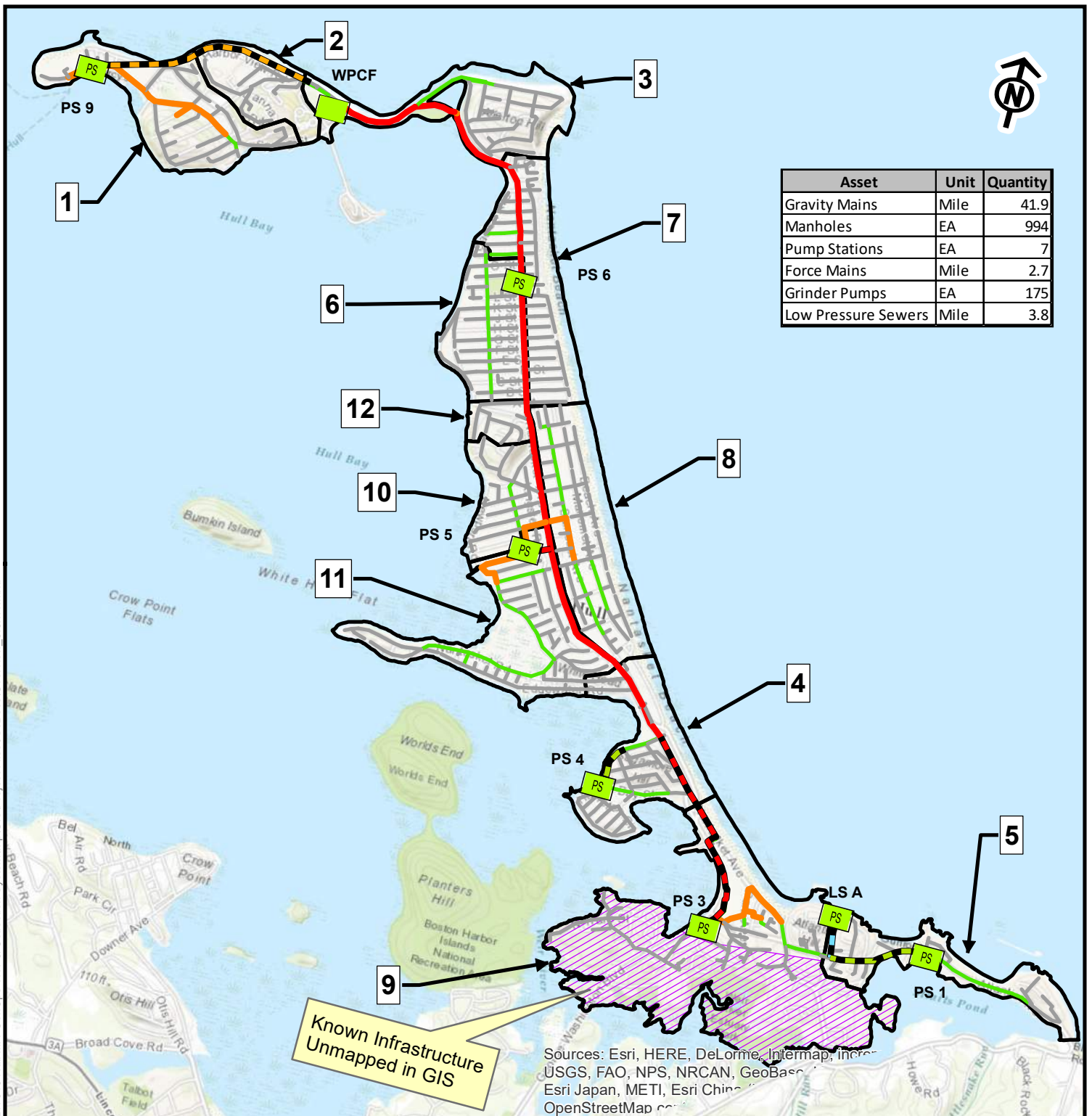
- Offices
- Bathrooms and Locker Rooms
- Kitchen/Break Room
- Storage Rooms and Closets
- Garage Areas
- Stairways and Hallways
- Remote Pump Rooms within the Plant

All the above-mentioned areas will need upgrades and major repairs that need to be included in an overall facility asset management plan.

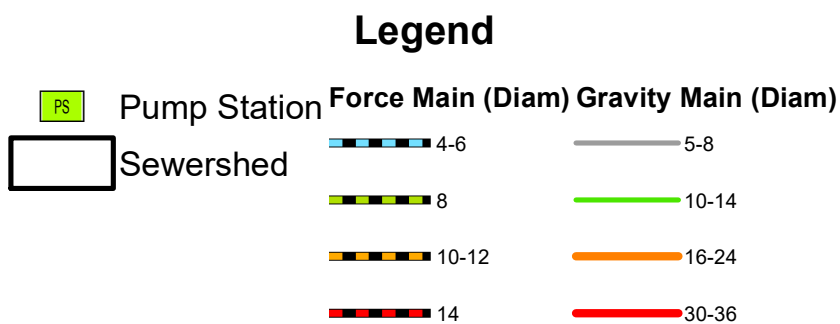
2.2 Collection System

An accurate database of collection system assets is a foundational element of effective wastewater system management. Asset data plays an essential role in Capacity, Management, Operation and Maintenance (CMOM), capital improvement planning, and compliance programs. The Town's collection system assets include gravity and low pressure sanitary sewer pipes, manholes, pump stations, with associated force mains, and grinder pumps, which work together to convey wastewater to the Hull WPCF. W&C quantified and evaluated these assets by researching historical plans and maps provided by the Town's Sewer Department, as well as collecting asset information through daily WPCF Operations.

One of the focuses of recent activities was to conduct a condition assessment of the interceptor sewer since it is one of the most vulnerable assets in the system due to the amount of flow that it transports and the high probability of deterioration from hydrogen sulfide corrosion. W&C utilized the Town's existing GIS as a repository for basic asset data (e.g. location, size, material, etc.) on most of the Town's collection system assets. Approximately 85% of the entire collection system has been inventoried using GIS, and the remaining assets will be added into the GIS system over the next several years. Elevation data (manhole rim and inverts, pipe invert in/out) data has not been digitized by the Town into GIS, but is maintained in the Town's record drawings. The Town has recently purchased an Arrow Gold GPS unit that will allow the Town to collect and verify field measured GPS and elevation data directly into their GIS database. Figure 2-2 shows the extent of the Town's collection system as maintained in their GIS database. The Town's GIS maintains both geographic and attribute data for its sewer pipes, manholes, force mains, and pump stations. A detailed breakdown of each collection system asset class is described in the sections below.



Asset	Unit	Quantity
Gravity Mains	Mile	41.9
Manholes	EA	994
Pump Stations	EA	7
Force Mains	Mile	2.7
Grinder Pumps	EA	175
Low Pressure Sewers	Mile	3.8



Sewer Collection System Overview

Town of Hull, MA

Figure 2-2



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SCALE: 1" = 2,920'	DOC: Overview_8.5x11.mxd
DATE: JUNE 2017	PROJECT #: 0217319.02
DRAWN BY: P.JL	SOURCE: Town of Hull, ESRI

2.2.1 Gravity Sewer Pipes and Manholes

The Town's gravity sewer collection system is designed to be a separated sanitary sewer system. Although connections between the stormwater drainage system and sanitary system are suspected to exist, direct and indirect connections are evident via increases in flow in the sanitary system during wet weather. Portions of the Town have been evaluated for infiltration and inflow response (I/I), however, the last comprehensive plan was completed over 15 years ago. The Town will begin to implement a CMOM Corrective Action Plan during the summer of 2017 which is a strategic document that will focus on improving acknowledged deficiencies in the capacity, management, operation, and maintenance of the collection system.

The gravity collection system is comprised of pipes and manholes of varying installation age, material, and diameters. The overall layout of the collection system can be seen on Figure 2-2. Ultimately, sewer flow is collected by smaller diameter sewer pipes and transported to the Town's 30-36-inch reinforced concrete interceptor. The interceptor, originally installed in the mid-1970s was partially rehabilitated by the Town in 2006 and 2011 by installing cured-in-place pipe lining in areas at the time that showed severe deterioration. Table 2-2, and Figures 2-3 through 2-5 summarize the Town's gravity sewer pipe and manholes material and diameter.

Table 2-2: Gravity Collection System by Sewershed

Sewershed	Sewer Pipe (LF)	Manhole Count
1	18,666	82
2	6,100	33
3	20,127	82
4	24,364	101
5	12,473	61
6	26,723	92
7	18,340	95
8	23,304	102
9	21,565	106
10	12,799	59
11	31,968	151
12	4,579	28
Total	221,007	994

Figure 2-3: Gravity Sewer Length by Diameter

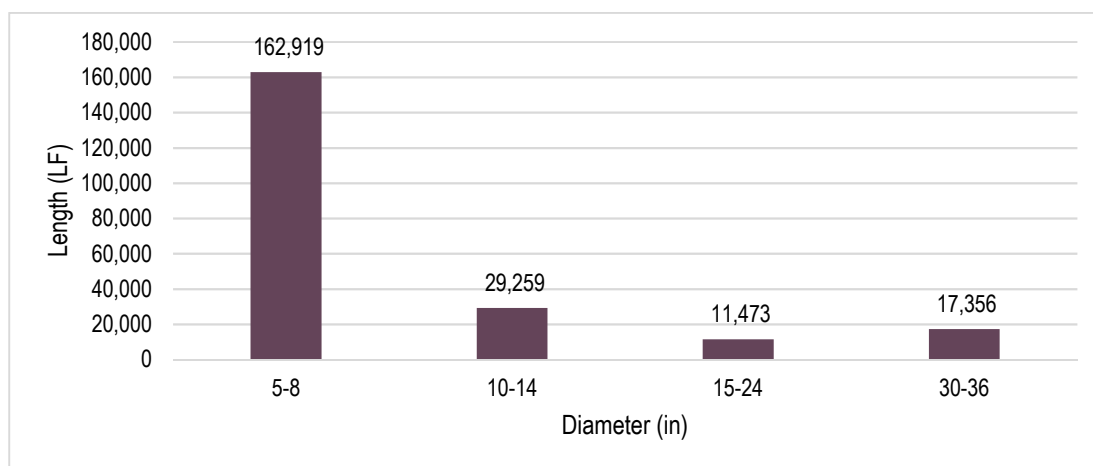
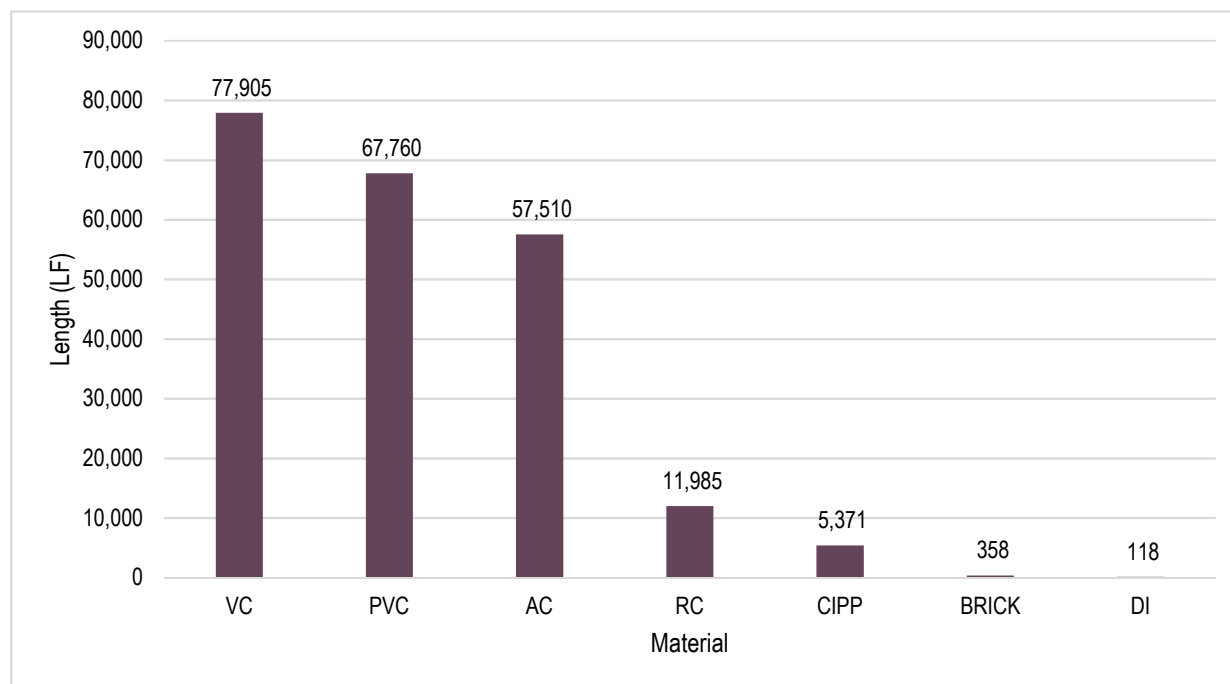
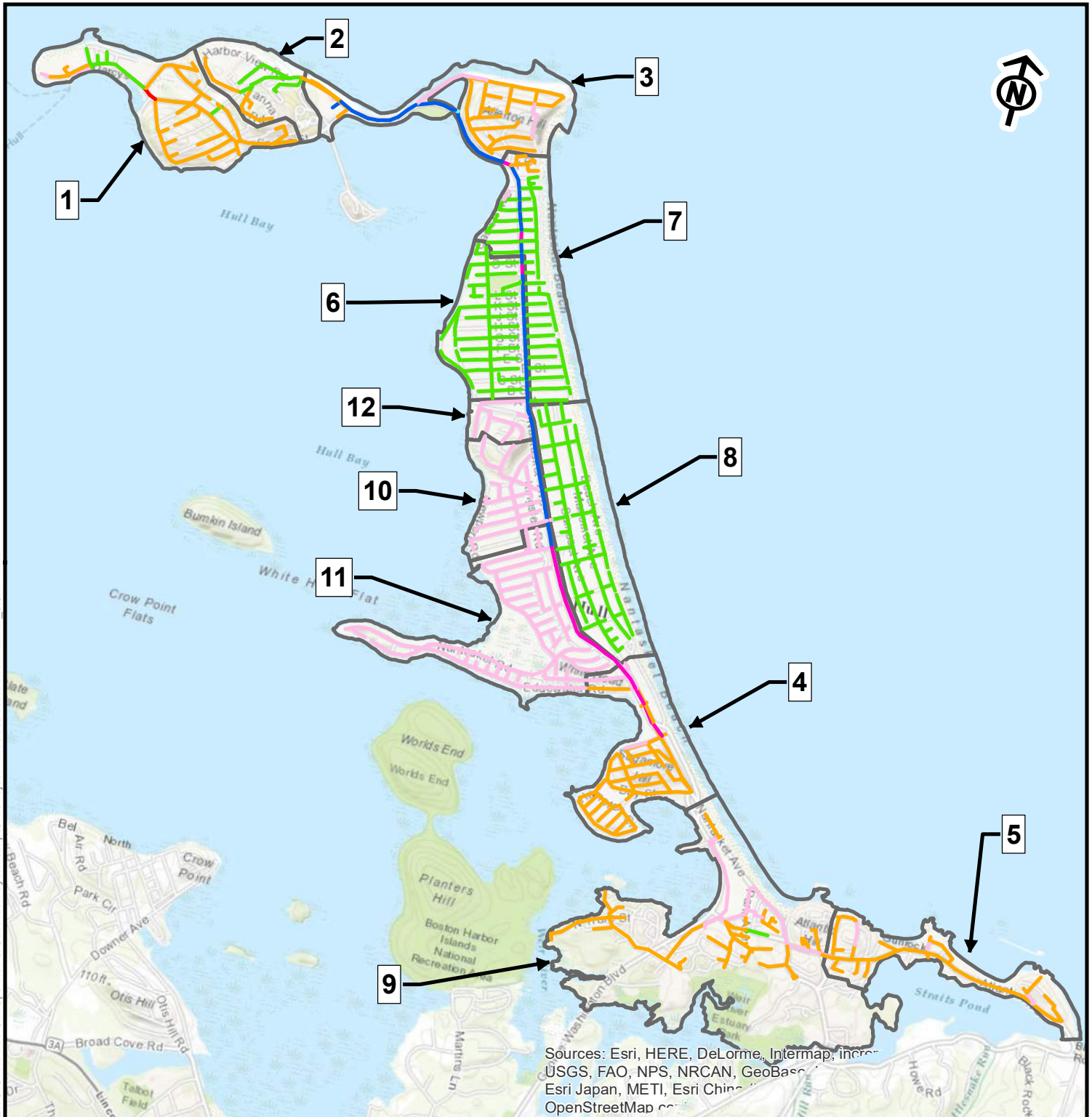










Figure 2-4: Gravity Sewer Length by Material





Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, Swisstopo, Esri Japan, METI, Esri China, OpenStreetMap contributors, Swisstopo

Legend

-  Sewershed
- Gravity Main**
-  AC
 -  BRICK
 -  CIPP
 -  DI
 -  PVC
 -  RC
 -  VC

Sewer Collection System Overview Sewer Main Material Town of Hull, MA

Figure 2-5



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SCALE: 1" = 2,920'

DOC: SewerMaterial_8.5x11.mxd

DATE: JUNE 2017

PROJECT #: 0217319.02

DRAWN BY: PJL

SOURCE: Town of Hull, ESRI

2.2.2 Pump Stations

Within the Hull POTW, there are seven sanitary sewer pump stations. The SEMS database provided a complete asset inventory for the Town's pump stations, but lacked ancillary data (such as asset nameplate information, performance testing and/or consistent component consequence assessments). See Table 2-3 for a summary of the station design information.

Table 2-3: Pump Station Inventory

Asset	Location	Generator	Design Capacity (gpm)	Approx. Age (years)
Station A	Valley Beach Rd.	No*	200	40
Station 1	Atlantic Ave.	Yes	450	40
Station 3	George Washington Blvd.	Yes	1700	40
Station 4	Marginal Rd.	Yes	800	40
Station 5	Draper Ave.	Yes	1600	40
Station 6	L St. Playground	Yes	670	27
Station 9	Main St. High School	Yes	650	40
*Transfer Switch, portable generator connection and portable generator are available.				

The data was imported into Utility Cloud© for integration and comparison among other assets. Based on the asset inventory from SEMS, most pump stations had a comparable number of assets. Examples of the assets which most stations had inventoried include:

- Pumps
- Wet Well
- Back-up Power (Generator)
- Motor Control Center/Power Supply
- Building
- Wet Well Aeration Equipment
- HVAC
- Instrumentation and Controls
- Force mains

The force mains carry the wastewater from each pump station to a discharge point in the gravity network. In general, all force mains are of original installation and consist of ductile iron, except for the force main for P.S.9 which was replaced in 2011 with 10-inch HDPE. Table 2-4 the force mains by pump station and Figure 2-6 shows the location of the pump stations and their force mains.

Table 2-4: Force Main by Pump Station

Pump Station	Diameter (in)	Material	Length
LS A	4	DI	871
PS 1	8	DI	2,138
PS 3	14	DI	4,763
PS 4	8	DI	1,136
PS 5	14	DI	584
PS 6	6	DI	78
PS 9	10	HDPE	4,863

2.2.3 Grinder Pumps

The town owns and operates 175 grinder pumps in the southern portion of the town as evidence in Figure 2-2. There are approximately 25 privately owned grinder pumps. These grinder pumps connect to a low-pressure force main that is approximately 20,000 LF in length.

3 RISK ASSESSMENT

This section of the report introduces the concept of risk analysis to prioritize the Town's POTW, including the WPCF, gravity collection system, pump stations, force mains, and grinder pumps. Using a standardized risk assessment process detailed below, this analysis will guide the Town towards an effective and informed maintenance and capital improvement strategy. There are two critical components of risk analysis and each rely on data to calculate risk associated with an asset.

$$\text{Risk} = \text{Likelihood of Failure} \times \text{Consequence of Failure}$$

The two components of risk, as defined by the National Association of Sewer Service Companies (NASSCO), are as follows:

- **Likelihood of Failure (LOF):** A numerical representation that denotes the probability of failure based upon an asset's physical condition. LOF is scored using a numerical range from 1-5, where a score of 5 indicates that the asset very likely to fail or has very significant defects. For example, the LOF for an asset may be known via inspection or may be estimated based on engineering judgment (e.g. it is estimated that a vitrified clay pipe may be more *likely to fail* than a polyvinyl chloride pipe).

LOF scoring is used for the following actions:

- Assess structural or operational condition of an asset.
- Prioritize assets for rehabilitation or replacement.
- **Consequence of Failure (COF):** A numerical representation that is the combination of direct and indirect impact on the vicinity and the community due to potential asset failure. COF is scored using a numerical range from 1-5, where a score of 5 indicates that the failure of an asset has an extreme consequence of failure. Assets which have the high COF scores can be considered *the most critical* components of the Town's sewer system. For example, a 36-inch interceptor sewer located on a busy roadway near the ocean may have a greater economic, social, and environmental impact than a smaller diameter sewer on a side street.

COF scoring is used for the following actions:

- Prioritize assets for inspection and maintenance to develop predictive maintenance procedures.
- Prioritize assets for rehabilitation or replacement.

For the Pump Stations and WPCF, the criteria are slightly more specific, but the definition of risk in general, as stated above, is consistent across all three asset categories: Collection System, Pump Stations and WPCF.

3.1 WPCF LOF & COF Scoring

For the WPCF basis of LOF and COF Scoring is based on the 2006 USEPA GHD Asset Management Workbook, with citation as follows: "The workbook is copyrighted by GHD. It is intended for the use of and licensed for use by utility staff and public officials. Feel free to modify it to fit your organization, but please assure proper citation." The spreadsheet was partially modified by Tighe & Bond to expand the asset class expected service life table. There were several criteria which were assessed as a part of comprehensive asset LOF and COF scoring, such as current known condition information, residual useful life, performance, reliability, and importance to treatment process.

3.1.1 WPCF LOF Scoring

The LOF analysis looked at the different failure modes of the WPCF equipment, and the potential paths to reach ultimate failure. The different failure modes used for the LOF analysis included failure by end of residual useful life based on actual age and condition assessment, failure by lack of performance (aka undersized), or failure due to reliability.

Since an asset could fail by any of these failure modes, the worst resulting failure mode is used as the assets LOF. Each of the failure modes are compared by converting the results to a percentage. That percentage represents the certainty that the asset will fail. Below is a description of the data considered and mathematical method of how each failure mode assessment reaches the LOF percent.

Residual Useful Life (age and condition) Assessment

The residual useful life analysis is a traditional method for equipment replacement. Assets are categorized by asset class which is then referenced to assign a standard expected life for the asset.

Table 3-1: Expected Service Life

Class	Asset Type	Standard Expected Life (yrs.)
1	Civil	40
2	Pressure Pipework	40
3	Sewers	100
4	Pumps	20
5	Valves	30
6	Motors	35
7	Electrical	35
8	Controls	25
9	Building Assets	60
10	Land	300
11	Equipment (40 years)	40
12	Equipment (20 years)	20
13	Equipment (10 years)	10

A condition rating is assigned to provide equipment specific adjustment to the standard expected life rating. For example, if an asset requires frequent maintenance, but is still meeting performance requirements, then it would require a condition rating of 4. If performance begins to drop, or a major part needs to be replaced, then it moves up to a condition rating of 5 or higher. See Table 3-2 below for a description of each condition assessment rating.

Table 3-2: Condition Assessment Rating

Condition Rating	Description	Maintenance Level
1	New or Excellent Condition	Normal PM
2	Very Good Condition with minor signs of wear	
3	Good Condition with Minor Defects Only	Normal PM, Minor CM
4	Fair to Good Condition	

5	Fair Condition/Moderate Deterioration	Normal PM, Major CM
6	Moderate to Significant Deterioration	
7	Significant Deterioration	Major repair, rehabilitate
8	Very Poor Condition	
9	Imminent Failure	Rehab unlikely
10	Unserviceable/ Failed	Replace

Based on the installation date of the equipment, the actual age is calculated. The standard remaining life (Expected - Actual) is then calculated and adjusted based on a table of correction factors.

$$\text{Remaining Life} = \text{Asset Type Expected Life} - \text{Age}$$

$$\text{Residual Useful Life} = \text{Remaining Life} * \text{Condition Factor}$$

If the equipment is beyond the standard expected life, meaning it has a negative remaining life, a different table of condition adjustment factors is used.

Table 3-3: Remaining Life Condition Adjustment Factors

<i>Positive</i>		<i>Negative</i>	
Condition	Factor	Condition	Factor
1	1.5	1	0.9
2	1.4	2	0.8
3	1.3	3	0.7
4	1.2	4	0.6
5	1.05	5	0.5
6	0.87	6	0.4
7	0.68	7	0.3
8	0.47	8	0.2
9	0.25	9	0.1
10	0	10	0

The result provides a residual useful life based on the actual age, and a condition assessment. The residual useful life is converted into a percentage of asset consumed by comparing the residual useful life with the standard expected life for that type asset.

$$\% \text{ LoF} = \left\{ 1 - \frac{\text{Residual Useful Life}}{\text{Asset Type Expected Life}} \right\} * 100\%$$

Performance Assessment

This LOF factor provides the Town the ability to identify equipment that is underperforming and prioritize it quickly. For each asset, the following performance assessment criteria were applied (Table 3-4), but for items where the status is unknown, the value was left blank.

Table 3-4: Performance Assessment

Performance Rating	Description	Performance LOF
1	Exceeds / Meets all Performance Targets	0%
2	Minor Performance Deficiencies	5%
3	Considerable Performance Deficiencies	20%
4	Major Performance Deficiencies	50%
5	Does not meet any Performance Targets	100%

Reliability Assessment

Like the performance assessment, the reliability assessment allows assets to be prioritized before the end of its useful life. The table below presents the numerical values and resulting LOF values used in the assessment.

Table 3-5: Reliability Ratings

Reliability Rating	Description	Failure Timing	Reliability LOF
1	As Specified by Manufacturer	Never	0%
2	Random Breakdown	Every 20 Years	5%
3	Occasional Breakdown	Every 5 Years	20%
4	Periodic Breakdown	Every 2 Years	50%
5	Continuous Breakdown	= 1 year	100%

LOF Results

LOF is the asset's highest percentage likelihood of failure of the three failure modes.

3.1.2 WPCF COF Scoring

The consequence of failure of an asset is one of the most important factors for asset management. As such for the WPCF, a 1 to 10 scale factor was assigned several reference values to assist evaluators such as the description of the consequence, the percentage of the total system affected, and the level of failure which would occur. Using these values, a consequence of failure for each asset was derived.

Table 3-6: Consequence of Failure Scoring

COF Rating	Consequence	Description	% Affected	Level
1	No Consequence	easily resolved, no impact	0-25%	Asset (component)
2	Minor	low mech. Low permit	25-50%	Asset (primary)
3	Low	med. Mech. Minor permit	0-25%	Asset (major)
4	Low-Avg	major mech. Moderate permit	25-50%	Unit process Minor
5	Average	major mech likely permit	50-100%	Unit process Major
6	Average	Minor System Failure	20-40%	Total System
7	Avg-High	Minor - Medium System Failure	40-60%	Total System
8	High	high alert major process failure	60-80%	Total System
9	Major	emergency status	80-90%	Total System
10	Catastrophic	Total	90-100%	Total System

3.2 WPCF Risk Assessment

WPCF data from the 2014 Tighe & Bond asset spreadsheet was reviewed and correlated/combined with the W&C CMMS SEMS asset database. The risk analysis was then updated data was input into the required fields for each asset into the above format. The updated risk analysis was based on the most recent W&C capital repair/recommendation plan, condition information available from open work orders, and other condition assessment information and reports (structural reports, pump efficiency testing reports, etc.). Each asset which had COF and LOF was evaluated for the above criteria, and those values have been assigned to the assets which make up the system. The numerical values used to perform WPCF risk assessment were normalized to a 1-5 scale to align the WPCF results with the other POTW sector assessments, as described later in Section 3.5. The WPCF assets with risk assessment scores were included in the total Priority Asset List found in Section 3.5 and Appendix C, and detailed bundling of assets into capital projects is described in Section 4.1

3.3 Collection System LOF & COF Scoring

The Town's collection system poses unique operational and economic challenges. The analysis below will guide decision makers to make informed decisions that maintain the function of the collection system cost effectively. For each asset class below, a detailed description of the risk components, COF and LOF, will be provided. At the end of the section priority list of assets that will be tabulated.

Collection system assets were evaluated for LOF using approaches specific to each asset class. These approaches are described in the following sections and are scored with values that range from 1-5, where a score of 5 indicates that the asset has at least one very significant defect.

3.3 Collection System LOF & COF Scoring

The Town's collection system poses unique operational and economic challenges. The analysis below will guide decision makers to make informed decisions that maintain the function of the collection system cost effectively. For each asset class below, a detailed description of the risk components, COF and LOF, will be provided. At the end of the section priority list of assets that will be tabulated.

Collection system assets were evaluated for LOF using approaches specific to each asset class. These approaches are described in the following sections and are scored with values that range from 1-5, where a score of 5 indicates that the asset has at least one very significant defect.

Table 3-7: LOF Scoring

LOF Score	Condition Assessment
1	Asset has negligible defects
2	Asset has low priority defects
3	Asset has medium priority defects
4	Asset has high priority defects
5	Asset has extreme priority defects

Collection system assets were evaluated for COF using the criteria outlined below.

Pipeline Diameter/Flow:

This category accounts for the effect of pipe diameter on the Consequences of Failure. Pipes in Hull's wastewater collection system range from under 5 inches to 36-inches in diameter. Larger pipes and attached manholes would be more disruptive and expensive to replace or repair. Larger diameter pipes also carry higher flow rates, resulting in greater consequences to property, public health, as well as higher economic cost of repair.

Street Classification:

This category accounts for the impacts of asset failures to traffic flow, accessibility for construction, and safety. For example, if a pipe or manhole failed under a major arterial street, traffic delays and diversions would likely affect more people than if a pipe failed on a residential street. A sinkhole caused by a collapse would affect more people in a major street than in a minor one. This category is based on street classification from MassDOT's road GIS layer. Assets located in "cross-country" areas are considered to have a medium consequence of failure because it is likely that accessibility is compromised, thus delaying response efforts.

Serves Critical Users:

This category helps prioritize assets that serve critical users including: schools, health care facilities, tourist attractions (beaches, Nantasket Beach Resort), and public safety (fire and police stations). The failure of an asset serving these users or nearby to these users, such as an overflow onto their property or a sewer collapse limiting access, could prevent them from functioning.

Schools and tourist attractions are considered critical users because the impacts of a failure could affect many people or cause loss of revenue. Health care facilities, fire, and police stations are considered highly critical because impacts could reduce their ability to protect public health and safety. Parcels containing critical users were determined from GIS data sources, including parcel data and Mass GIS layers. The nearby collection system serving that parcel were considered to have a high or severe Consequence of Failure.

Proximity to Water Resource:

This category accounts for the impacts to water resources due to sewage spills and repair activities resulting from an asset failure. Originally, water resources were identified using the MassDEP Wetlands. However, Hull is a coastal resource area and thus this was not a significant differentiating factor and therefore not utilized

Finally, with aid from the Town, a water resource database was developed and used as a consequence of failure factor. For example, a sewer failure located on Fitzpatrick Way may cause sanitary sewer overflow directly into the surrounding bay resulting in social impacts (i.e. negative news coverage), environmental impacts (i.e. sanitary sewer overflow to the ocean), and economic impacts (i.e. fines and difficulty of construction near the bay).

Proximity to Drinking Water (Not Applicable to Hull):

This category accounts for the impacts to surface drinking water supply resulting from an asset failure. Drinking water sources were identified using the MassDEP Surface Water Supply Protection Zones dataset. This dataset delineates the zones surrounding surface water supplies that are covered by legislation.

However, Hull does not have any sewers near protected surface water protection zones and therefore a geospatial analysis was not completed for this factor. Spatial analysis for failure near water mains was not performed for this iteration of the asset management report, however could be integrated in the future if/when water main sizes and locations are shown on the geospatial mapping.

Table 3-8 defines relative scoring numbers for estimated environmental, social, and economic consequences of failure. The scoring is based on Woodard & Curran's understanding of the Town's collection system and the estimated potential impacts associated with collection system failure. Table 3-9 summarizes the COF scoring used to evaluate the Town's collection system assets. An asset's total consequence of failure is equal to the summation of its individual score in each category.

Table 3-8: COF Scoring by Impact

COF Score	Societal/Environmental Impacts
1	No risk of injury; in-house work item; minor/no environmental damage; \$1K-20K or less total financial impact
2	Low risk of injury, no service, reputation, or media impacts, minor environmental damage; \$20K-50K total financial impact
3	Medium risk of injury, minor service & reputation impacts, no media, possible environmental damage, \$50K-250K total financial impact
4	Significant risk of injury; reputation impact and local media attention; intermittent services; localized environmental damage & fines, \$250K-\$750K total financial impact
5	Significant risk of serious injury or death, major reputation impact and media coverage; complete disruption of services; significant environmental damage & fines; \$750K or greater total financial impact

Table 3-9: COF Scoring by Criteria

Criteria	COF Score				
	5	4	3	2	1
Critical Users	Health Care Facilities, Schools, Hotels	Fire/Police Department	Recreation Area	-	Residential/Other
Location of Pipe	Major Road – Numbered Highways	Major Road – Collectors	Cross Country (Pipes and Manholes)	Minor Street	Maintained Easement
Gravity Sewer Diameter/Flow	24-36"	14-18"	10-12"	-	<=8"
Force Main Diameter/Flow	14"	10"	8"	4-6"	-
Proximity to Critical Water Resource	-	Adjacent to Resource	-	-	Not Adjacent to Water Resource

3.3.1 Gravity Sewer Pipe

The results of the LOF and COF scoring is summarized below.

3.3.1.1 Gravity Sewer LOF

LOF for gravity sewer pipe was determined using a multi-parameter process that considers both recent NASSCO Pipeline Assessment Certification Program (PACP) inspection data and the material of the pipe. More specifically, pipe LOF was determined by utilizing the peak defect score of early 2017 CCTV inspection of the interceptor and portions of the collection system (3% of the gravity pipe) or if recent inspection was not completed for the pipe section the likelihood of failure was estimated using pipe material and estimated date of installation. LOF scoring by material is an estimate based upon knowledge of the system by Town staff and collection system operators. As CCTV inspection progresses in the Town, a larger percentage of the gravity pipe's LOF will be determined from CCTV inspection data. This will provide a better understanding of the condition of the collection system.

Table 3-3 summarizes the Spring 2017 CCTV inspection data by pipe length. CCTV inspection was completed in the Gunrock/Atlantic Avenue area, along sections of the Town's reinforced concrete interceptor, Main Street, and Nantasket Road. Appendix A includes a figure that summarizes the Spring 2017 CCTV inspection that shows the locations and peak defect scores located by Wind River Environmental.

Table 3-10: Gravity Pipe Inspected Spring 2017 Peak Defect Score by Length

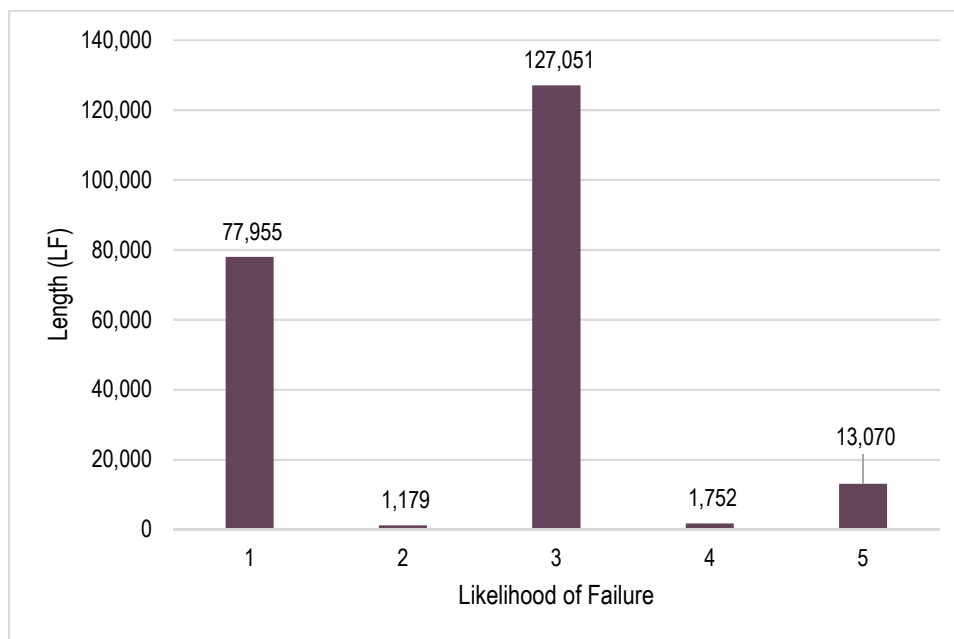
LOF Score	Pipe Length
1	4,613
2	1,657
3	1,175
4	2,125
5	3,611

Table 3-11: Gravity Pipe LOF Score by Material

Material	LOF Score
RC	5
DI	4
VC	3
AC	3
BRICK	2
CIPP	1
PVC	1

Figure 3-1 describes the LOF distribution of the Town's gravity sewer pipe. Notice that the distribution shows much of the collection system as scoring 3, this is because much of the Town's collection system is comprised of VC and AC sewer pipe and is estimated to not have significant defects that will lead to failure. See Appendix A for the locations and peak defect scores for individual pipes inspected in the Spring of 2017.

Figure 3-1: Gravity Sewer Pipe LOF Score by Length



3.3.1.2 Gravity Sewer Pipe COF

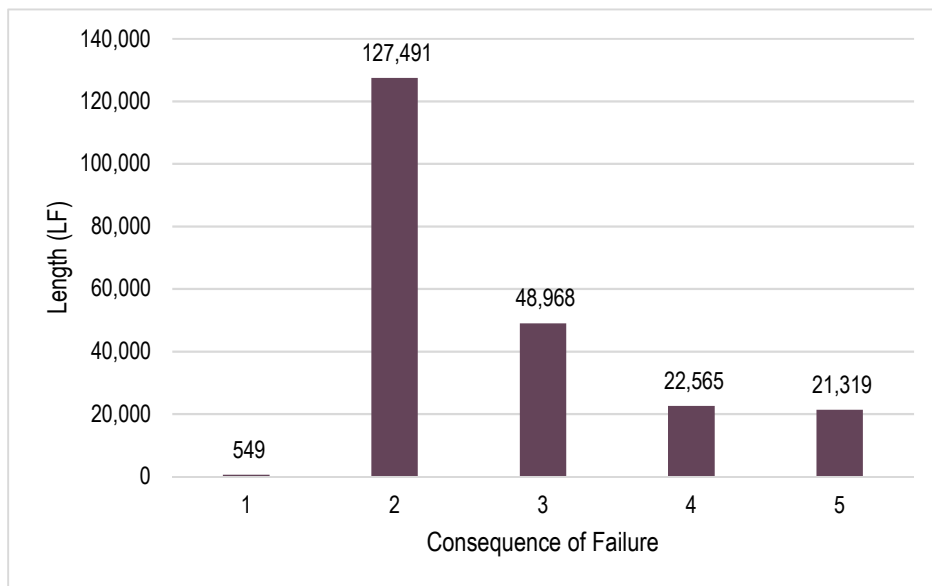
The Town owns approximately 42 miles of gravity sewer pipe that transports a current (2017) average daily flow of 1.7 MGD to the Hull WPCF. To assess the criticality of any pipe, the consequence of failure analysis above was calculated for each type of pipe. The results of this analysis are summarized below. Ultimately, this analysis identifies that the Town's 30-36-inch diameter interceptor sewer pipe has the highest consequence of failure. Particularly, failure of the 36-inch interceptor along Fitzpatrick Way poses an extreme consequence of failure due to the amount of wastewater flow it transports and proximity to both the Town's shoreline and along a highly traveled roadway. Failure of this asset would be costly to repair via emergency excavation and would likely produce a large SSO volume directly into the bay. In contrast, smaller diameter pipes (i.e. serve less residents and transport less flow) on a side street (easier emergency excavation, less traffic disturbance, little or no environmental impact) scores lower in the consequence of failure analysis. Below is list of the Town's gravity sewer with an extreme or severe consequence of failure:

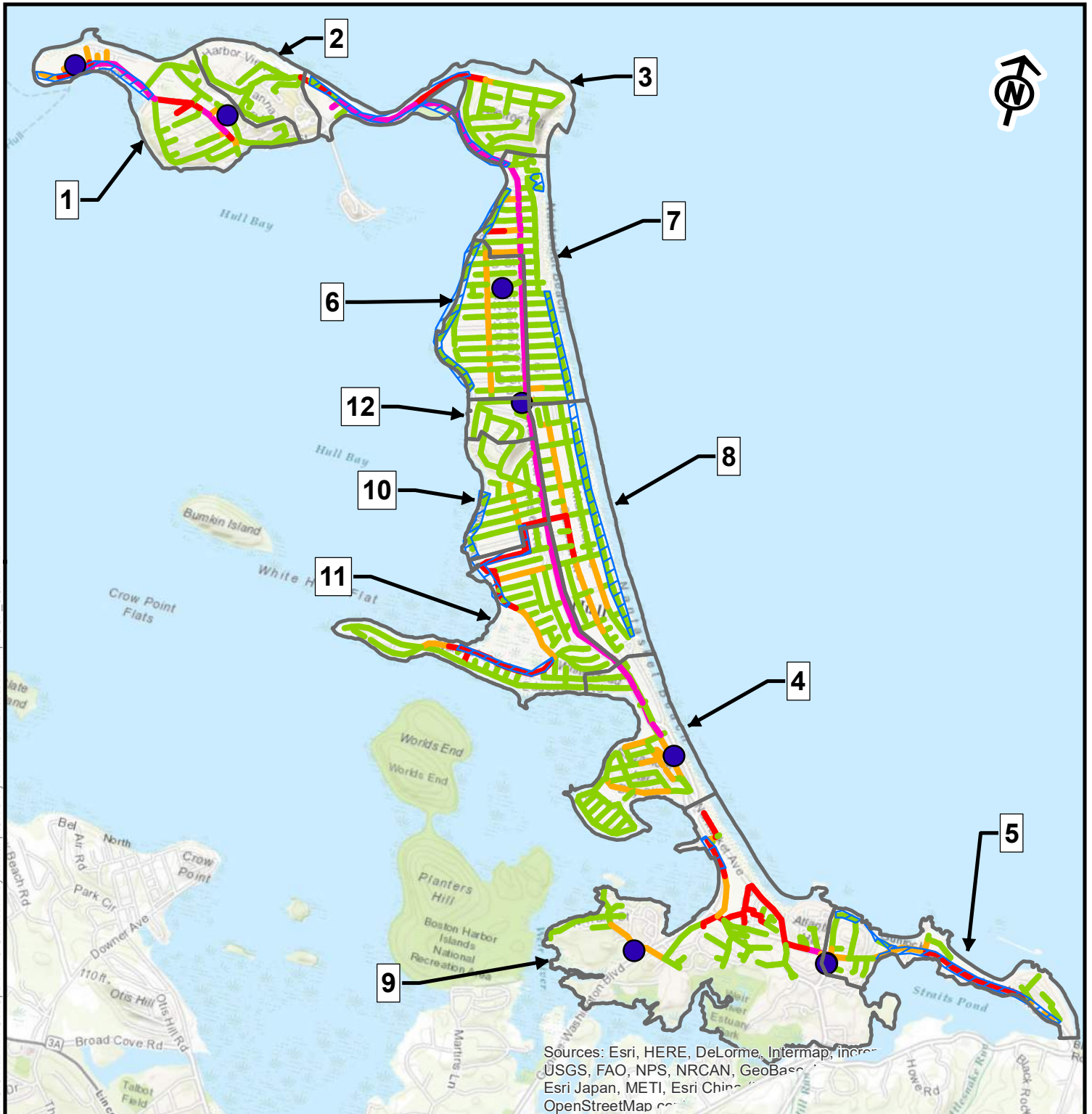
- 30-36-inch reinforced concrete & CIPP Interceptor along Nantasket Avenue and Fitzpatrick Way
- 18-24-inch reinforced concrete lagoon crossing located off Fitzpatrick Way
- Nantasket Avenue at Packard Avenue Siphon
- 18-24-inch PVC sewer pipe on Main Street near Hull High School
- 16-inch asbestos cement sewer pipe located along Draper Avenue near the Town's shoreline.
- 14-16-inch asbestos cement sewer pipe located along Nantasket Avenue and downstream of the Hull Fire Department and the Police Fire Department at Town Hall.
- 15-inch brick sewer on Main Street near the Hull Fire Department in the Village.

It is recommended that the Town prioritize inspection of these assets and all assets with a consequence of failure score greater than or equal to three, this is approximately 70,000 LF. A defined maintenance and inspection program of the Town's critical gravity sewer pipes will identify condition of these assets and allow for the Town to perform

rehabilitation/replacement before pipe failure occurs leading to emergency excavation. A breakdown of the Town's gravity sewer pipe COF distribution is summarized in Figure 3-2 and shown graphically in Figure 3-3.




Figure 3-2: Gravity Sewer Pipe COF Distribution





Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, Swisstopo, Esri Japan, METI, Esri China, OpenStreetMap contributors, Swisstopo

Legend

-  Sewershed
-  Critical Facilities
-  Shoreline

Gravity Main Consequence of Failure

-  1
-  2
-  3
-  4
-  5

Sewer Collection System Overview Gravity Sewer Pipe COF Town of Hull, MA

Figure 3-3



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SCALE: 1" = 2,920'	DOC: SewerPipeCOF_8.5x11.mxd
DATE: JUNE 2017	PROJECT #: 0217319.02
DRAWN BY: PJL	SOURCE: Town of Hull, ESRI

3.3.2 Sewer Manholes

The results of the LOF and COF scoring is summarized below.

3.3.2.1 Sewer Manhole LOF

LOF for sewer manholes was determined using a multi-parameter process that considers both recent manhole inspection data and the material of downstream pipe. More specifically, manhole LOF was determined by utilizing the manhole inspections in the Spring of 2017 (focusing in the locations where CCTV was also completed) or if recent inspection was not completed for the manhole the likelihood of failure was estimated using the “worst case” pipe material as described in Table 3-3 (i.e. if a pipe was connected to both reinforced concrete pipe and CIPP rehabilitation, the manhole was given a LOF score associated with the reinforced concrete pipe.)

LOF scoring by material is an estimate based upon knowledge of the system by Town staff and collection system operators. As manhole inspection progresses in the Town, a larger percentage of the sewer manhole’s LOF will be determined from manhole inspection data. This will provide a better understanding of the manhole conditions throughout the system.

Table 3-12 summarizes the LOF scoring determined by W&C staff while performing NASSCO Level 1 Manhole Assessment and Certification Program (MACP) manhole inspections. Table 3-13 also summarizes the LOF score relative to manhole type and connecting sewer material. Figure 3-4 summarizes the Town’s gravity sewer manholes by LOF score.

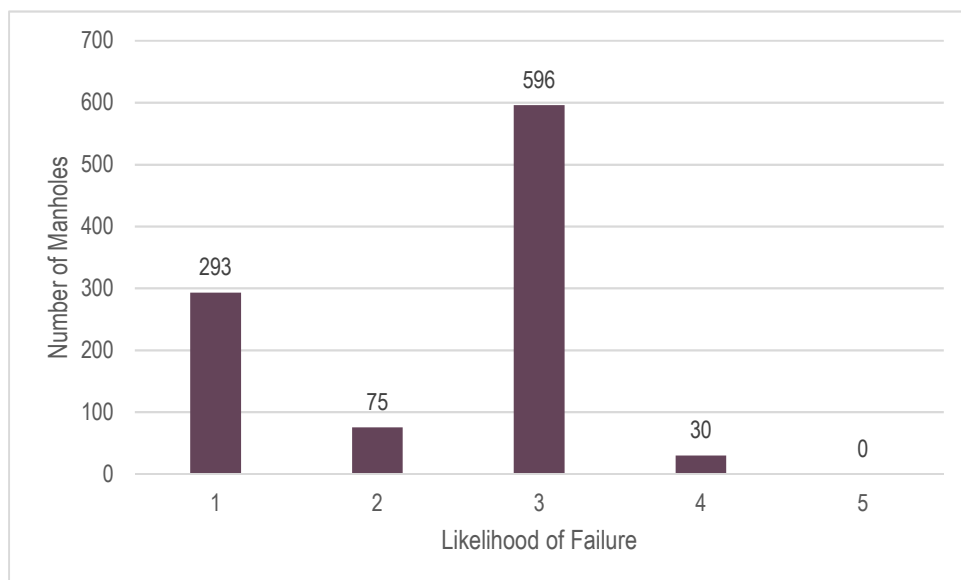
Table 3-12: MH LOF Determined by Field Inspection

Spring 2017 LOF	MH Count
1	6
2	76
3	32
4	9
5	0
Total:	123

Table 3-13: MH LOF Criteria and Distribution

US/DS Pipe Material	MH LOF Score	MH Count
AC	3	277
Brick	2	2
CIPP	1	9
DI	4	0
PVC	1	284
RC	4	56
VC	3	364
Null (Unknown in GIS)	4	2
Total:		994

Figure 3-4: Gravity Sewer MH LOF Distribution



The Town has recently completed a MH inspection program targeted at the 30-36" reinforced concrete interceptor and these scores are incorporated into the LOF analysis. A figure showing the Town's manhole inspection completed in the Spring of 2017 is included in Appendix A.

3.3.2.2 Sewer Manhole COF

The Town's existing GIS database contains 994 sanitary sewer manholes. As future collection system investigation continues, the Town's GIS will become more complete and will update their asset management plan will be updated. These sanitary sewer manholes operate as access points for inspection and maintenance of the collection system's gravity sewers. Sewer manhole COF follows a similar spatial distribution as the Town's gravity sewer pipes as the same geoprocessing methods were utilized. Below is a list of the Town's critical manholes with an extreme or severe consequence of failure:

- Manholes located along the 30-36-inch reinforced concrete & CIPP Interceptor along Nantasket Avenue and Fitzpatrick Way
- Manholes located along the 18-24-inch PVC sewer pipe on Main Street near Hull High School
- 14-16-inch asbestos cement sewer pipe located along Atlantic Avenue, and downstream of Town Hall, where there is a Police and Fire Department.

Figure 3-5 summarizes the Town's gravity sewer manhole COF distribution and shown graphically in Figure 3-6.

Manhole Consequence of Failure

- 1
- 2
- 3
- 4
- 5

Figure 3-5



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SCALE: 1" = 2,920'

DOC: SewerMHCOF_8.5x11.mxd

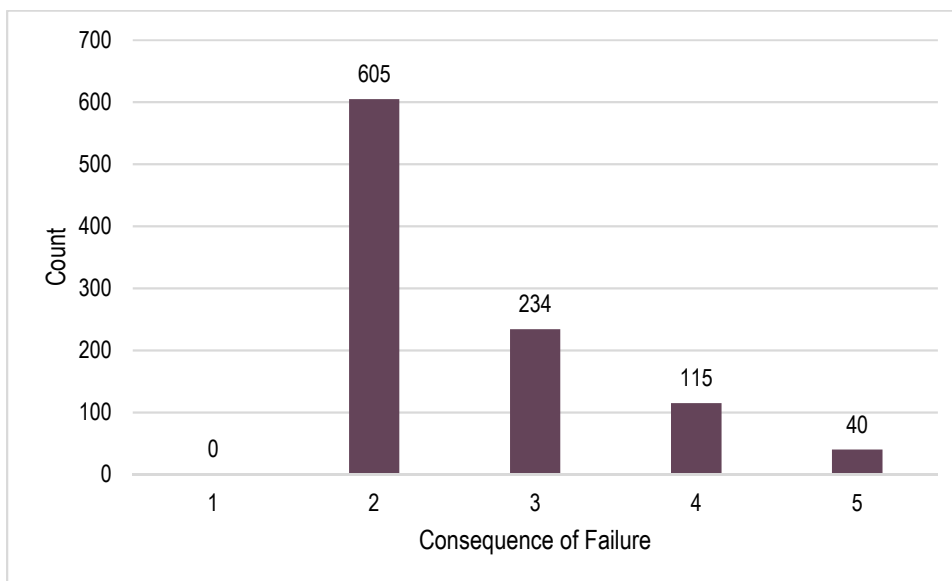
DATE: JUNE 2017

PROJECT #: 0217319.02

DRAWN BY: P.J.L.

SOURCE: Town of Hull, ESRI

Figure 3-6: Gravity Sewer Manhole COF Scoring



3.3.3 Force Main

The results of the LOF and COF scoring are summarized below.

3.3.3.1 Force Main LOF

Hull has approximately 2.7 miles of force main. The Town has not adopted a preventative maintenance inspection for any of the force mains and thus no CCTV or other inspection method could be utilized for LOF scoring. To generate LOF scoring for Hull's seven force mains, recent performance (structural failure, SSOs, prescribed maintenance schedule) was evaluated distribute LOF scoring. Table 3-14 summarize the LOF scoring for each individual force main.

Table 3-14: Force Main LOF Scoring

Force Main	Diameter (in.)	Material	Length (lf)	LOF Score
PS 3	14	DI	4,763	5
LS A	4	DI	871	4
PS 4	8	DI	1,136	3
PS 1	8	DI	2,138	3
PS 6	6	DI	78	2
PS 5	14	DI	584	2
PS 9	10	HDPE	4,863	1

It is estimated and presumed that the 14-inch diameter force main from PS 3 is in poor condition and will need to be rehabilitated/replaced soon based on a previous sectional liner installed at the force main discharge location and the recent pinhole leak observed on the pump discharge piping. PS 4 has also experienced several breaks over the years, and frequent maintenance has been incorporated based on its structural history. The PS 9 force main was recently replaced with 10-inch HDPE in 2011.

3.3.3.2 Force Main COF

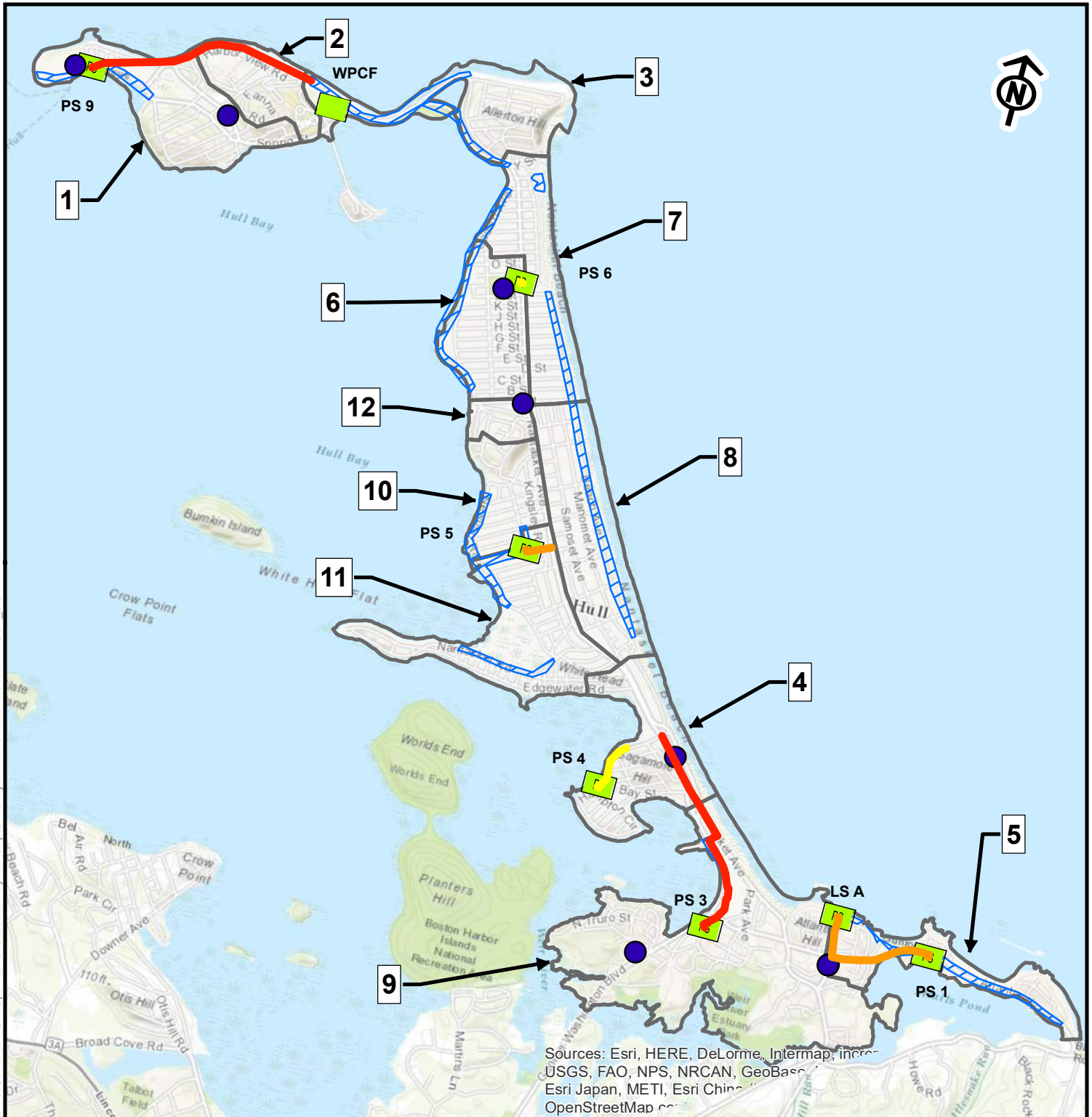
The Town owns seven pump stations that utilize almost three miles of pressurized sewer main. In general, failure of a force main causes moderate to extreme damage due to the potential consequences of failure (large volumes of SSO, PS damage, high sewage bypass costs, environmental impacts, residential and business disruption, public lack of confidence and credibility, etc.). Below is a brief description of the Town's most critical sewer force mains with severe to extreme consequences of failure:

- 14-inch ductile iron force main from PS 3 along George Washington Boulevard and Nantasket Avenue is critical due to the amount of flow it transports and its location on a highly traveled roadway.
- 8-inch force main from PS 1 along Atlantic Avenue is critical due to its location near the shoreline, its proximity to the Hull Police and Fire Department and its location on a highly traveled roadway.
- 4-inch force main from LS A along Valley Beach Road is critical due to its location near the shoreline, its proximity to the Hull Police and Fire Department.
- 6-inch force main from PS 6 onto Nantasket Avenue from the L Street field is critical due to the amount of flow it transports and its proximity to a highly traveled roadway and recreational field.
- 10-inch HDPE force main from PS 9 between the High School, Harborview Road area, and the WPCF is critical due to the amount of flow it transports and its proximity to Hull High School, commuter boat parking, and the shoreline.

The force mains listed above represent the Town's most critical force mains and should be inspected on a regular basis to better understand structural integrity which will lead to rehabilitation/replacement prior to failure reducing emergency excavation costs and other economic, environmental, and social costs. Table 3-15 summarizes each sanitary sewer force main by COF. Figure 3-7 shows locations of the Town's force mains with associated consequences of failure.





Table 3-15: Force Main COF Scoring

Pump Station	Diameter (in.)	Material	Length (lf)	COF Score
PS 3	14	DI	4,763	5
LS A	4	DI	871	4
PS 4	8	DI	1,136	3
PS 1	8	DI	2,138	4
PS 6	6	DI	78	3
PS 5	14	DI	584	4
PS 9	10	HDPE	4,863	5



Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, Swisstopo, Esri Japan, METI, Esri China (Hong Kong), Swisstopo, OpenStreetMap contributors, and the GIS User Community

Legend

-  Sewershed
-  Critical Facilities
-  Pump Station
-  Shoreline

Pressurized Main Consequence of Failure

-  1
-  2
-  3
-  4
-  5

Sewer Collection System Overview Sewer Force Main COF Town of Hull, MA

Figure 3-7



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SCALE: 1" = 2,920'

DOC: SewerFMCOF_8.5x11.mxd

DATE: JUNE 2017

PROJECT #: 0217319.02

DRAWN BY: PJL

SOURCE: Town of Hull, ESRI

3.3.4 Pump Stations

The risk assessment was performed based previous pump station condition assessment reports and on the operation staff's direct experience with the equipment. This assessment effort was an efficient method for providing a high-level condition and consequence assessment. The operations team's familiarity with the assets, and all the factors that weigh into such an analysis, naturally prioritizes assets in the current state. However, it is recommended that more specific performance, redundancy, maintenance and repair data be incorporated so that a more comprehensive failure mode analysis on the pump stations can be developed. The failure mode analysis assessment ensures proper long term prioritization of assets while utilizing operational activities and data. The risk analysis ranked all assets on a 1 (best condition, least consequence) to 5 (most likely to fail, highest consequence) LOF and COF score. The results of the Pump Station risk are summarized in the figures below.

Figure 3-8: Pump Station Assets by LOF

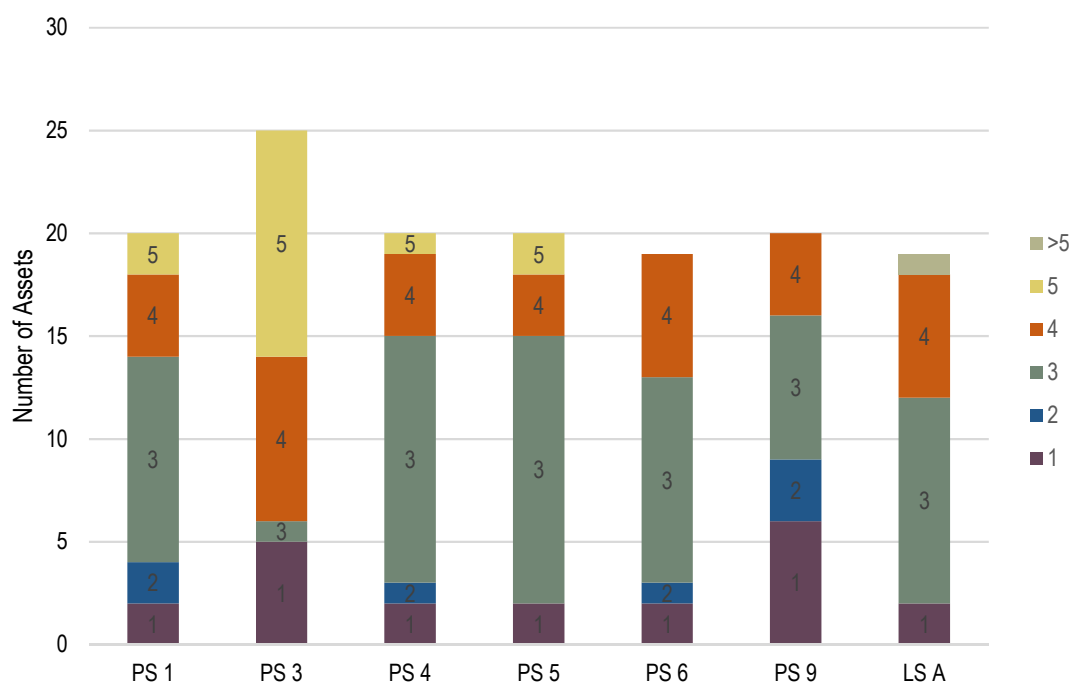


Figure 3-9: Pump Station Assets by COF

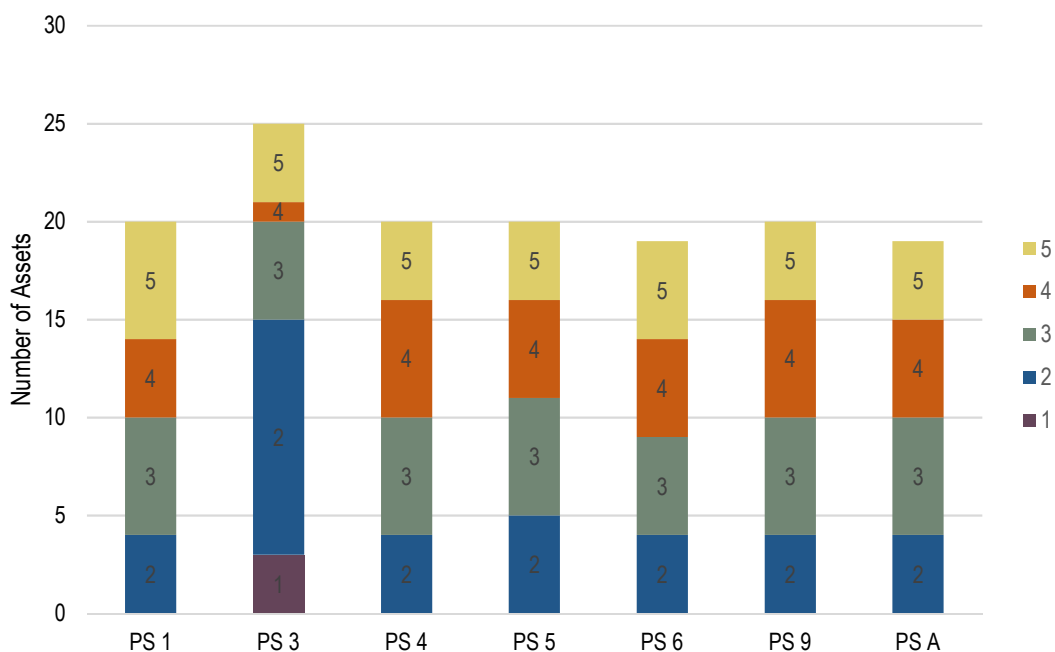
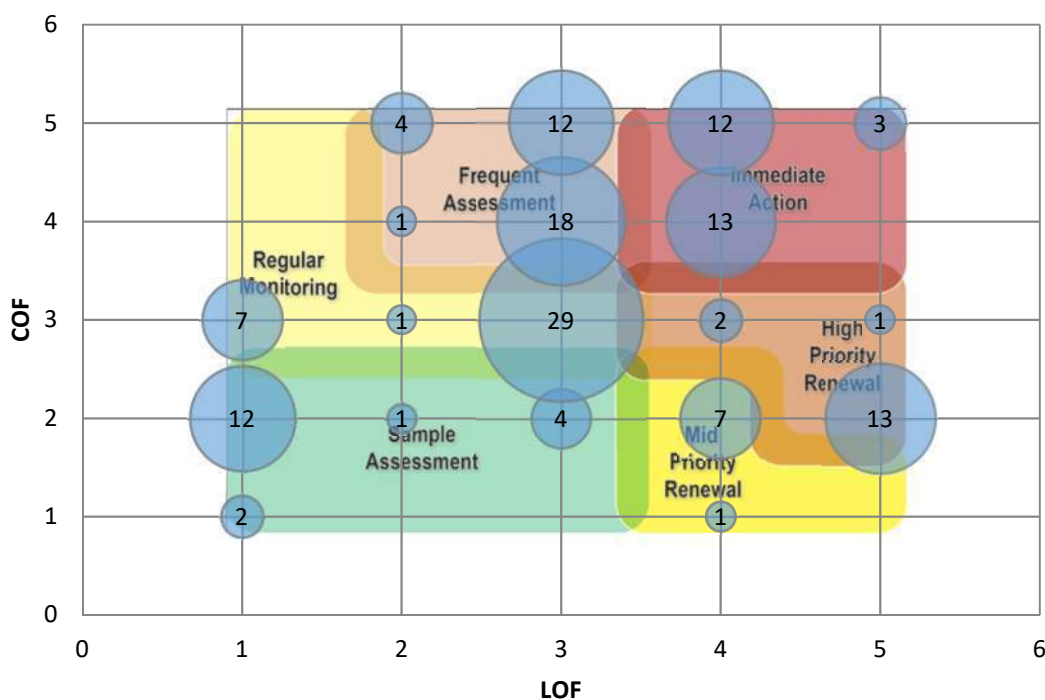


Figure 3-10: Count of Pump Station Assets by Risk Category



Per Figure 3-10, there are 28 assets which fall into the “Immediate Action” category, summarized in Table 3-16 below.

Table 3-16: High Risk Pump Station Assets

Asset Name	Station	LOF	COF	Rating
PS 1 Wet Well	PS 1	4	5	4-High
PS 1 Piping and Valves	PS 1	4	5	4-High
PS 1 SCADA Panel	PS 1	4	4	4-High
PS 1 Modem	PS 1	4	4	4-High
PS 3 Piping and Valves	PS 3	5	5	5-Extreme
PS 3	PS 3	5	5	5-Extreme
PS 3 Wet Well	PS 3	4	5	4-High
PS 3 Electrical MCC	PS 3	4	5	4-High
PS 3 Building	PS 3	4	4	4-High
PS 4 Wet Well	PS 4	4	5	4-High
PS 4 SCADA Panel	PS 4	4	4	4-High
PS 4 Modem	PS 4	4	4	4-High
PS 5 Wet Well	PS 5	4	5	4-High
PS 5 SCADA Panel	PS 5	4	4	4-High
PS 5 Modem	PS 5	4	4	4-High
PS 6 Wet Well	PS 6	4	5	4-High
PS 6 Electrical MCC	PS 6	4	5	4-High
PS 6 Building	PS 6	4	5	4-High
PS 6 SCADA Panel	PS 6	4	4	4-High
PS 6 Modem	PS 6	4	4	4-High
PS 9 Wet Well	PS 9	4	5	4-High
PS 9 SCADA Panel	PS 9	4	4	4-High
PS 9 Modem	PS 9	4	4	4-High
PS A Wet Well	PS A	4	5	4-High
PS A Electrical MCC	PS A	4	5	4-High
PS A Building	PS A	4	5	4-High
PS A SCADA Panel	PS A	4	4	4-High
PS A Modem	PS A	4	4	4-High

3.3.5 Grinder Pumps

The Town owns approximately 175 grinder pumps and four miles of low pressure sewer in Sewershed 9, as shown in Figure 2-1. Within the Town GIS, there is limited data on location, asset type and number of homes serviced by grinder pumps within the low-pressure sewer system. While paper records do exist, they have not been incorporated into the Town’s GIS and therefore do not have consistent maintenance records. It is also suspected that some grinder pumps serve multiple users, but until accurate mapping can be completed or service is performed, locating these grinder pumps should be prioritized for inspection to minimize users affected by a failure. The pressure sewer manholes, cleanout valves, and air release valves need to be inventoried and have condition assessments completed.

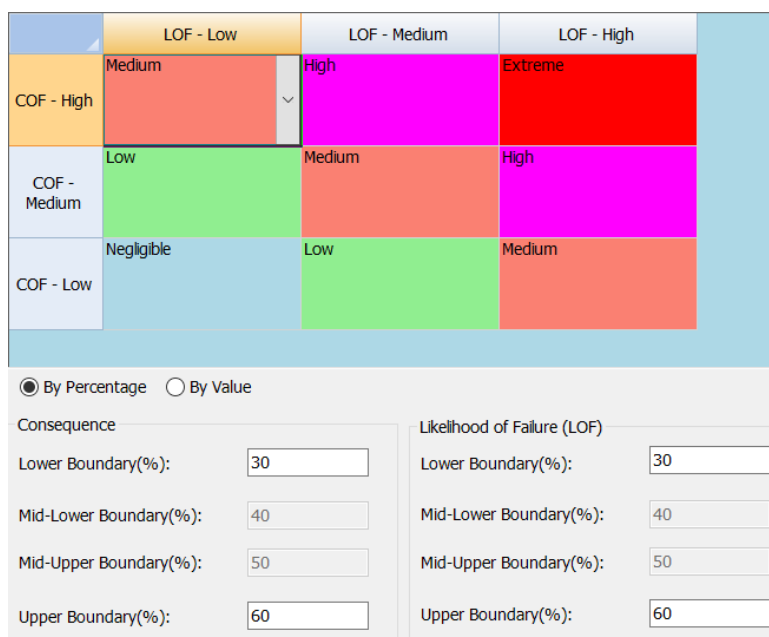
As the Town develops their inspection database and uses GPS units to find digitized locations of the grinder pumps and low pressure sewer, COF and LOF can be calculated more precisely. For the purposes of this assessment, all grinder pumps can be considered to have a consequence of failure of 2 or “low” due to a small quantity of users being affected during failure and that the little environmental and social costs are expected. Once grinder pumps are incorporated into the Town GIS, then the Utility Cloud© asset management system can assign formal inspection records to refine information presented in this report.

3.4 Collection System Risk Assessment

This section summarizes risk associated with each asset given the COF and LOF analysis completed above. Risk is a function of COF and LOF and will be used to develop specific rehabilitation projects and studies that aim to mitigate risk associated with known failure probabilities. Specific projects identified from this risk analysis are detailed in Section 5.

To determine an asset’s risk category, the asset’s COF and LOF score are plotted into a risk matrix where the x-axis is LOF scoring and the y-axis is COF scoring. The risk matrix is set up in a 3x3 configuration such that the low, medium, and high LOF and COF values are defined by normalized boundaries at 0-30 percentile, 30-60 percentile and 60-100 percentile. These boundaries were used for risk assessment of gravity main, manholes, and force mains. Grinder pumps were not analyzed using this method as the exact location and functionality is should be better understood before this analysis is performed. Pump stations were not included using this analysis as W&C performed the COF and LOF analysis on the individual parts of the pump station, rather than the pump station as a whole. The 3x3 risk assessment matrix is calculated as follows:

Figure 3-11: Risk Assessment Matrix



These boundaries set up distinct risk levels where an extreme risk is posed by any asset that is both very likely to fail and has a very high consequence of failure, for example segments of the Town’s reinforced concrete interceptor.

An important note to the collection system risk analysis is that condition of the collection system has been estimated from record drawing data via pipe material (i.e. assumed LOF scoring) and field inspection of assets. As field inspections are completed for assets, they will be incorporated into the asset’s LOF and score and the risk assessment

will be updated. It would be prudent for the Town to consider rehabilitation for areas that have utilized field inspection (e.g. in the form of CCTV inspection of MH inspection). For portions of the collection that have not been recently inspected, and therefore have been given an estimated LOF score, W&C recommends inspection based on COF scoring. Using this method, the Town would inspect collection system assets starting at “extreme” consequence of failure and working towards “medium”. Assets with a COF score of less than “medium” may be only inspected if failures occur (e.g. customer complaints, sinkholes, SSOs) or the DPW budget allows. With the assumptions about pipe material in mind, Table 3-17 and Figure 3-12 through Figure 3-15 summarize the Town’s collection system risk assessment.

Table 3-17: Collection System Risk Assessment Summary

Risk Category	Gravity Main Length (miles)	Count of Manholes	Force Main Length
1: Negligible	6.1	162	0.0
2: Low	21.1	136	0.0
3: Medium	8.8	387	1.1
4: High	3.3	204	0.5
5: Extreme	2.5	105	1.1
Total	41.8	994	2.7

Figure 3-12: Gravity Sewer Pipe Risk by Length

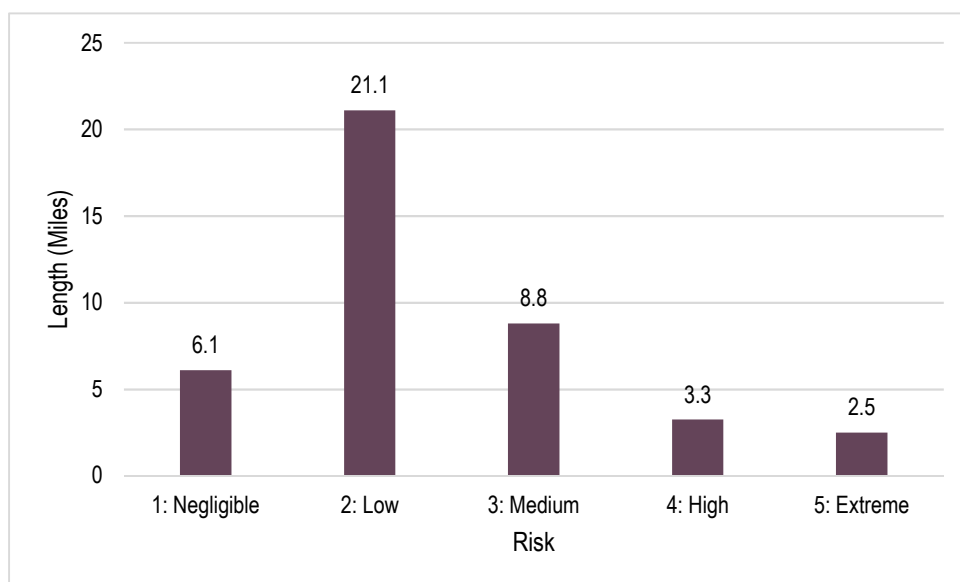


Figure 3-13: Gravity Manhole Risk by Count

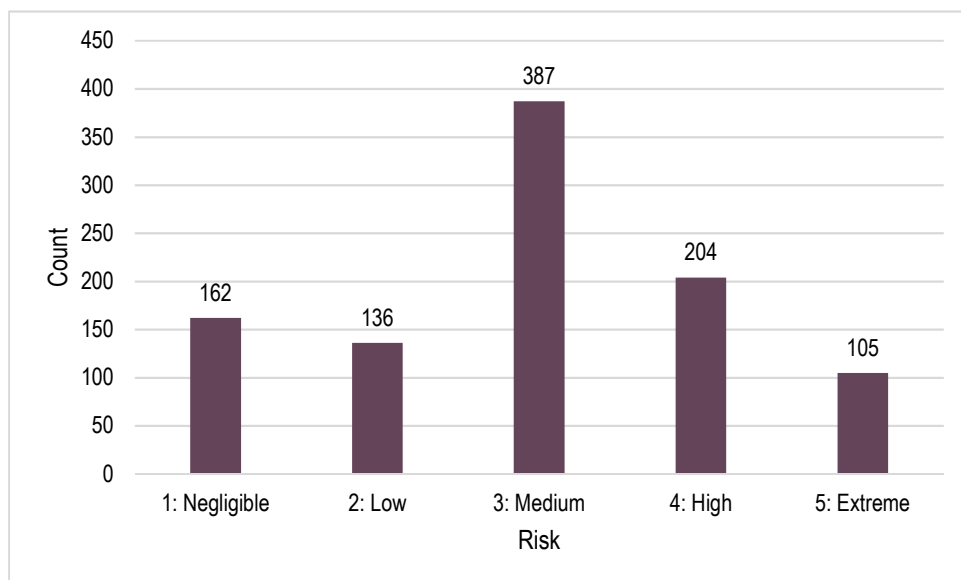


Figure 3-14: Force Main Risk by Length

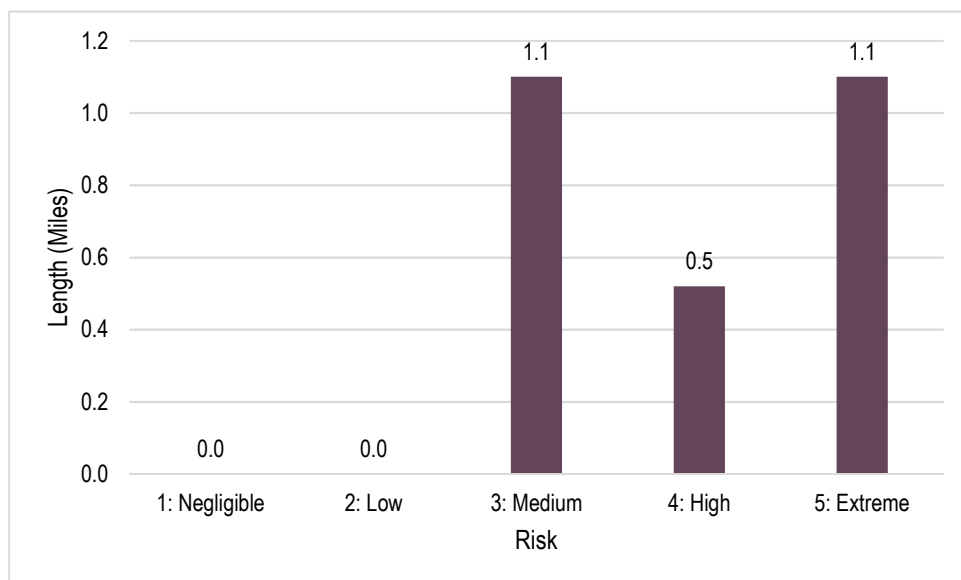
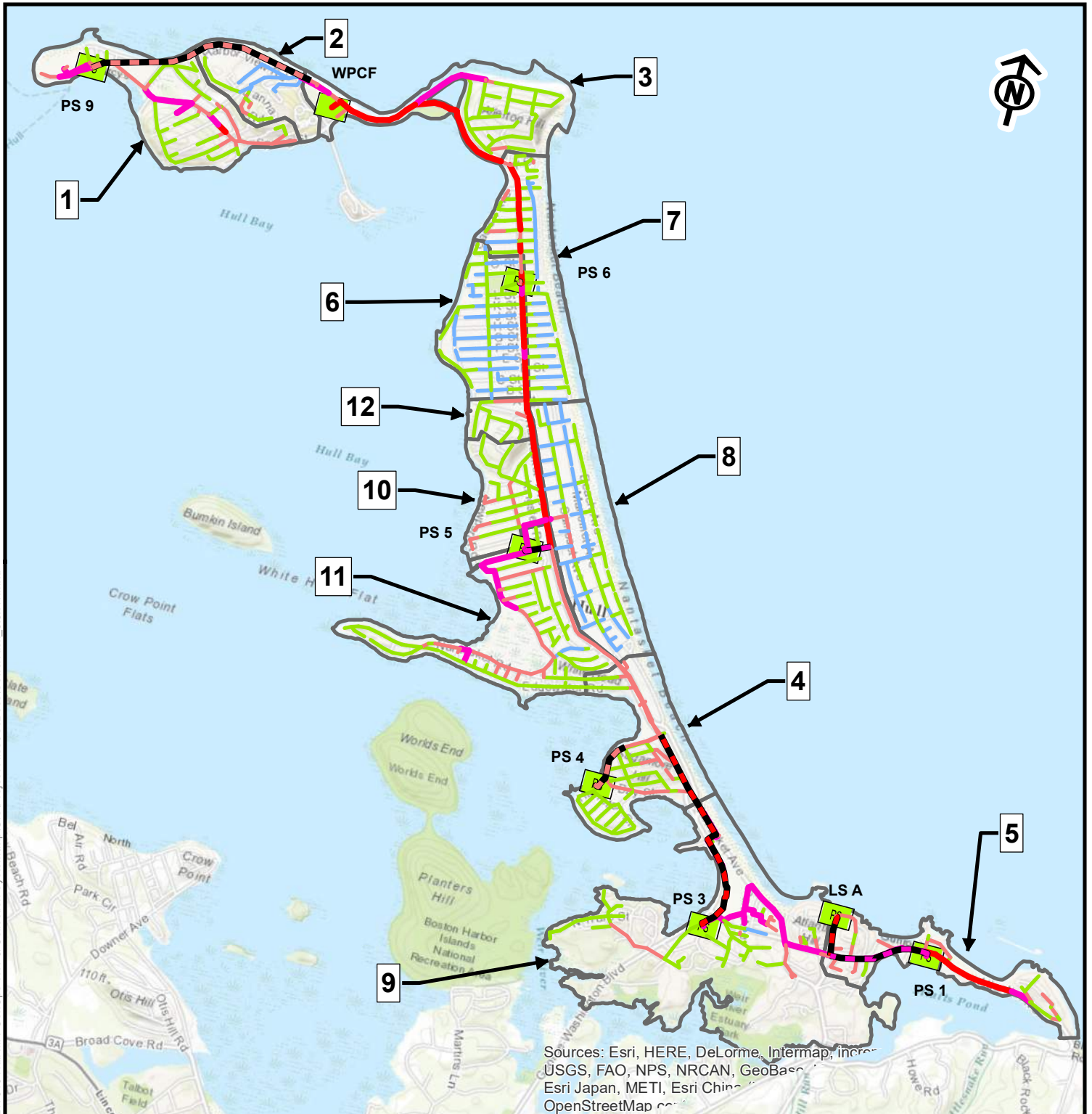


Figure 3-15 illustrates the risk associated with individual collection system assets. Note that manholes are not shown on the figure.



Legend

Sewershed	Gravity Main
Pump Station	Negligible
Force Main	Low
Medium	Medium
High	High
Extreme	Extreme

* Although risk was calculated for each sewer manhole, note that for clarity they are not shown on this figure. Manhole risk is similar to gravity pipe risk shown on this figure.

Sewer Collection System Overview Sanitary Sewer Risk Assessment Town of Hull, MA Figure 3-15



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SCALE: 1" = 2,920'	DOC: SewerRisk_8.5x11.mxd
DATE: JUNE 2017	PROJECT #: 0217319.02
DRAWN BY: PJL	SOURCE: Town of Hull, ESRI

3.5 Priority List of POTW Assets

The priority list of assets combines all the individual system evaluations onto a single list. The diverse nature of the individual systems introduces a degree of complexity because each system evaluation has been evaluated by a method best suitable for that system. A data normalization process, or adjustment of COF and LOF onto the same score scale. This was accomplished by using the following equations basic for LOF and COF:

$$\text{Normalized LOF} = \frac{LOF_{eval}}{MAX_{observ}(LOF_{eval})} * 100$$

$$\text{Normalized COF} = \frac{COF_{eval}}{MAX_{observ}(COF_{eval})} * 100$$

Then, each asset falls into a scaled score class: 0-30, 30-60, and 60-100. For each asset, the risk grade would be looked up based on the corresponding LOF and COF scores. Below is an image of the Risk Grade chart used.

Figure 3-16: Risk Grade

Normalized LOF	3	4	5
	2	3	4
	1	2	3
Normalized COF			

Then, the resulting risk grades were ranked from highest to lowest to determine the overall priority and secondary lists of assets. The priority list is comprised of extreme risk, or category 5 risk-ranked values. These assets require replacement or rehabilitation within the next 6-18 months and may require capital improvements.

Due to the large number of assets, sorting within the risk grade categories was necessary. Normalized risk was also calculated as a reference value to provide that sorting within the risk grading. The equation for normalized risk is below.

$$\text{Normalized Risk} = \frac{COF_{eval} * LOF_{eval}}{MAX(COF_{eval} * LOF_{eval})} * 100$$

The normalization process also scaled all the values for each system into a 1 to 5 scale for purposes of reference, since equipment is scored on a 1-5 scale. The equation below is the basic formula used to generate a scaled value for all assets.

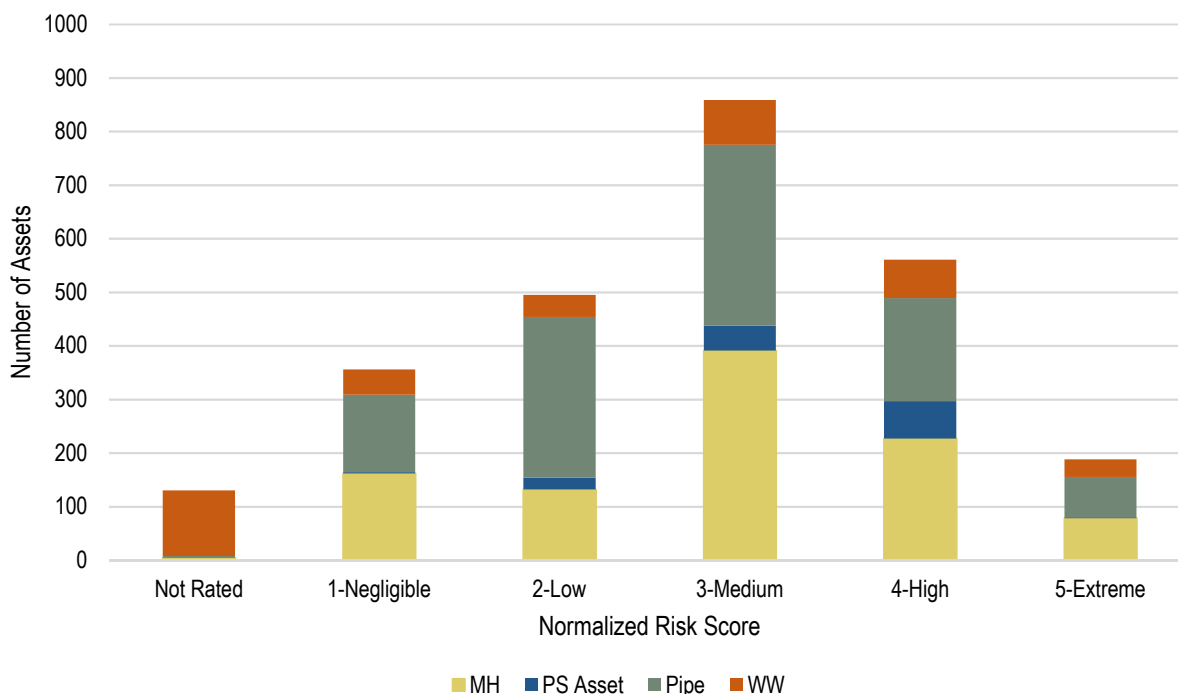
$$\text{Normalized LOF} = \frac{LOF_{eval}}{MAX_{observ}(LOF_{eval})} * 5$$

$$\text{Normalized COF} = \frac{COF_{eval}}{MAX_{observ}(COF_{eval})} * 5$$

Figure 3-17 summarizes the breakdown of POTW assets by Normalized Risk Score, and distribution by Asset Class. The most common normalized risk score is “3 – Medium,” with over 800 assets present. Overall, there are less than

200 “5 – Extreme” rated assets, but there are well over 500 “4 – High” risk assets. The WPCF contains the highest “unrated” portion of asset distribution, which suggests additional condition assessments should be prioritized to determine which risk score these unknown assets fall into.

Figure 3-17: Overall Risk Score Distribution of Combined Asset List

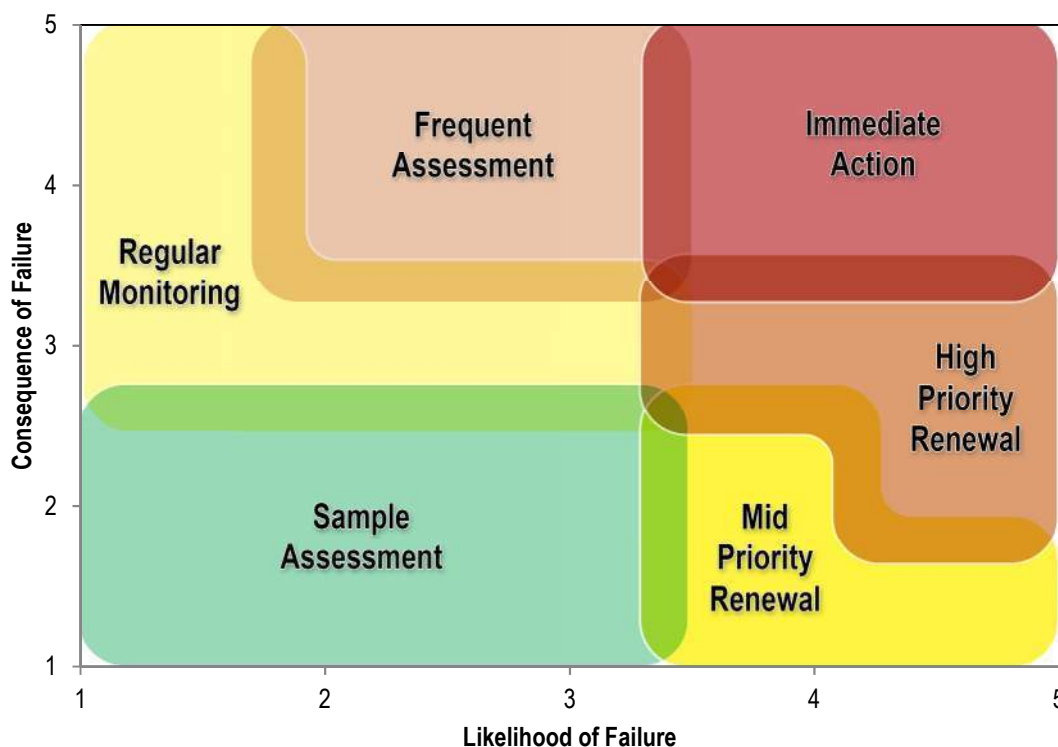


3.6 Secondary List of POTW Assets

The secondary list is comprised mostly of “watch-and-wait” continuous monitoring requirements (in general, combined risk score of less than 45). These assets are not immediately in need of replacement, but are recommended to be under regularly documented observation and testing requirements to observe the deterioration over time. By continuing to measure and observe the assets progress, the better timeline of replacement can be updated. In other words, these include items not included on the Capital Improvement List specifically, but are included as a part of long-term monitoring program (e.g. SSES and rehabilitation programs) and through improved inspection and CMMS work-order assignments.

The risk matrix action level chart, shown in Figure 3-18, illustrates how the LOF and COF of an asset can influence and prioritize the type of response or action necessary for maintaining the asset.

Figure 3-18: Risk Matrix Action Level Chart



While assets ranked on the right side of the risk matrix action level chart with a LOF greater than three should be a priority for renewal projects as described in Section 4, assets categorized on the left side of the chart should have Frequent Assessment, Regular Monitoring, and Sample Assessment incorporated into planned maintenance activities. These types of maintenance activities are described below:

- **Frequent Assessment:** Assets with a high COF are critical to the operation of the system and should be the highest priority assets in regards to maintenance activities to ensure they remain operational. As these assets' LOF increases, they become high risk assets, which require immediate action outside of regular maintenance activities.
- **Regular Monitoring:** Assets requiring regular monitoring may have a high COF and low LOF, such that they should be prioritized for maintenance to ensure they remain operational, because the high COF indicates that they are critical to the operation of the system. As these assets' LOF increases, they become high risk assets, which may require more frequent or immediate attention.
- **Sample Assessment:** Assets with a low COF and LOF are considered the lowest priority for maintenance activities and planning. The most cost effective method of maintaining these kinds of assets is to periodically observe and track the condition of the assets.

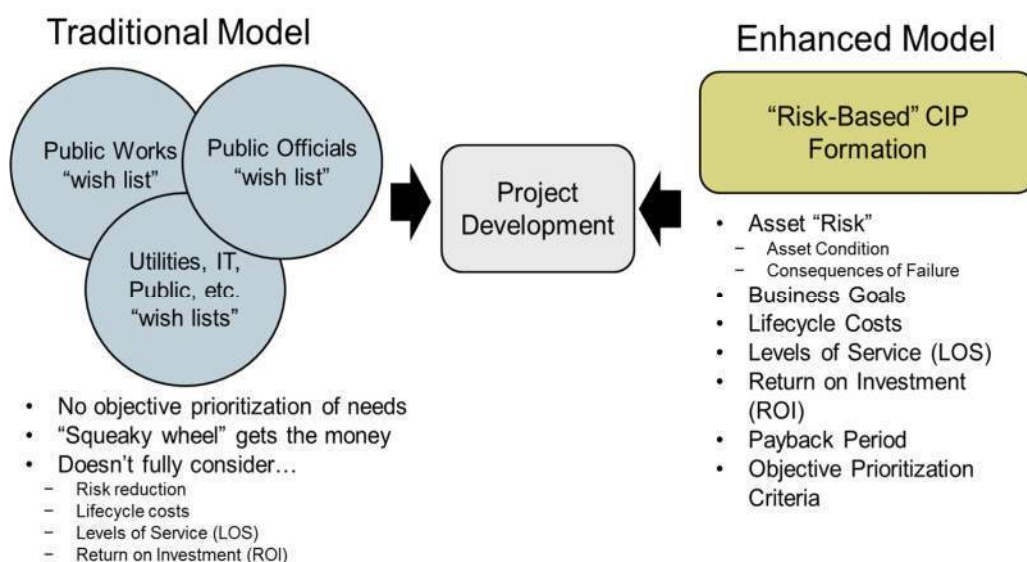
Effective capital planning ensures an organization's long-term sustainability by helping it deliver the desired levels of service at the lowest possible lifecycle costs, while managing overall risk. It requires a careful balance between the competing elements of money (funding), service and risk. Without the proper balance, negative consequences such as wasted resources, higher costs and unnecessary risks occur.

4 CAPITAL IMPROVEMENT PLANNING

The overarching philosophy of asset management-centric capital planning is to select and prioritize projects to reduce Business Risk Exposure, while ensuring that Level of Service Goals are achieved and life cycle costs are minimized. The organizations that represent local government and utility interests, such as the International Town/County Management Association (ICMA), the American Public Works Association (APWA), American Water Works Association (AWWA), and Water Environment Foundation (WEF), endorse enhanced capital planning using structured “risk-based” asset management approaches. Many public organizations practice the traditional capital improvement plan (CIP) model as shown on the left side of Figure 4-1.

The process typically involves department representatives developing a “wish list” of projects based on their experience and knowledge of their department’s assets, which are then brought to a finance or capital-planning group and pared down based on available budgets, historical spending trends and other subjective factors. Staff attempt to coordinate with broad organizational needs and goals, however the process is not objective or structured based on objective information. Risk reduction, lifecycle costs, return on investment (ROI) and levels of service (LOS) are not formally considered using this approach.

Figure 4-1: Traditional Model of CIP Development vs. Enhanced



The enhanced model is structured and more defensible as it results in overall lower asset costs and improved results. To achieve risk-based capital planning, the Town must continue to do two things:

Develop and follow a business case evaluation approach for capital projects, and

Develop a consistent and equitable approach to project prioritization.

Once all the potential projects have been identified in the capital planning process, project prioritization will then allow the Town to compare all projects consistently, score based on agreed metrics, and then rank each project. This approach has been used in the development of the recommended capital improvement plan and shows the estimated needed level of funding and timing for each project.

1.1 Annual Capital Improvements

For the following Capital Improvement plans, the risk-based list of assets was compiled and then projects were bundled together based on logical association to produce the Priority List of Assets (PLA) and Secondary List of Assets (SLA). For each asset, replacement costs were developed based upon a combination of vendor quotes (equipment), previous bid results, and industry experience with similar projects. Some estimates are based on preliminary engineering work, such as the Tighe & Bond HVAC system upgrade, designed after the 2013 flood event. The following capital plans prioritize work that needs to be done within years one, five and ten, reflecting the collection system, Pump Station and WPCF and resiliency projects. It is important to note that there are several immediate improvements in process for this year (2017); including the installation of a replacement influent flood protection gate and the permanent installation of the GODWIN Auxiliary pump at the WPCF.

4.1.1 One-Year Plan

The following grouped projects contain one or more extreme risk, or category 5, ranked assets. The following projects were included as priority year one items:

Table 4-1: One Year Capital Improvement Plan

Project Description	Estimated Cost
Reinforced Concrete Interceptor Rehabilitation	\$4,600,000
Gunrock Area Rehabilitation	\$970,000
I/I Study	\$230,000
Force Main 3 Rehabilitation	\$1,400,000
Vactor & TV Truck	\$400,000
UST Replacement	\$400,000
POTW Critical Spares/Replacements	\$200,000
Secondary Clarifier Upgrades	\$300,000
Total	\$8,500,000

As the CCTV inspection of Spring 2017 revealed, several segments of the Concrete Interceptor, Gunrock Area and Forcemain 3 need rehabilitation or repair. There were several segments of pipe shown in the Priority List of Assets which have been grouped into these three collection system projects. Year one costs associated the collection system work include estimates that include engineering and contingency. The costs associated with the other items are estimates based on preliminary purchase, repair and/or replacement quotes and will be further refined as the actual details of the work required are further defined, but do reflect anticipated costs to be incurred in the near future. Also, as a part of collection systems capital improvements, an I/I Study during the first year is recommended as well as cost-benefit analysis of purchasing a Town of Hull Vactor/CCTV truck, to implement more frequent pipeline assessment for segments/areas identified as in need of regular monitoring (currently, the Town of Hull and Contract Operator contract with subcontractors for this work).

The POTW critical Spares/Replacements “project” is on the year one priority list due to many failed pumps and other assets within the POTW, at both the Pump Stations and the WPCF. The estimated costs reflect anticipated repairs that are expected in the near future. The Secondary Clarifier Upgrade project is on the year one priority list due to known failure conditions with the secondary clarifiers. The actual failure details of the secondary clarifiers are unknown at this time as the exact cause of the failures has yet to be determined, but the draft tube systems on both secondary clarifiers are not functioning properly and extensive wear and tear on the gear boxes and rake mechanisms, due to excessive corrosion, are readily apparent and internal piping corrosion and leaks are suspected as well. The UST replacement project is on the priority list due to its age (40 years old) and the need to determine replacement options.

4.1.2 Five-Year Plan

The collection system CIP project list addresses the critical high risk infrastructure repairs initially, as noted above, then provides for an ongoing condition assessments and repairs of the remaining assets based on their risk grade. The collection system Goals of the five-year plan include setting up a long term SSES program, to better assess infiltration and inflow, identify areas where collection system failures or interconnections exist (and then abate them), continue to set up an effective FOG program to reduce system/service blockages and set up a full-time inspection system to allow for proactively educating business owners and other residents for the best care of their individual service connections. The collection system projects in year one total \$7.6 million dollars, then the next 9 years totals \$8.7 million dollars.

Outside of year one immediate repairs, the main objectives for the treatment plant capital plan include system, process and resiliency upgrades. Over \$20 million dollars of upgrade projects are proposed, including protection of the WPCF main power source and distribution equipment, backup power upgrades, storm flow discharge capacity upgrade, installation of a Vactor dump station and critical process upgrades; including: chemical system upgrades and/or rehabilitation, underground piping renewal/replacement/and/or relocation, pump repairs/replacements, etc. The basis of the priority list of assets is based on a combination of Woodard & Curran recommended capital repairs and improvements to the collection system and pump stations, as well as treatment plant equipment and unit process upgrade recommendations.

The resiliency upgrade projects are further described in Section 5.3 Resiliency and Adaptation Planning. The specific items identified include addressing the most critical assets, that are also vulnerable to the greatest risk of failure. The CREAT tool has been utilized to perform a preliminary review of risks and potential adaptation measures. Further analysis will be performed to provide guidance to the Town help to guide the decision making of the planned infrastructure investments for resiliency upgrades. The resiliency adaption measures within the plant include raising electrical components out of the basement (flood zone) and installing a perimeter wall around the plant, or sealing just the Control Building (i.e., raising the height of the storm gates, doors and walls that were put into place after the Blizzard of '78), and other similar site adaption improvements. The specific adaption measures have yet to be finalized and designed, so the cost estimates in the plan will be updated as the detailed design proceeds. The resiliency costs are estimates from several sources; for instance, the Tighe & Bond 1998 PEF provided a cost for adding a pumping system to the chlorine contact tank and outfall, so that estimate was increased for inflation to current costs. The costs associated with the pump stations resiliency measures were based on the preliminary findings in the 2016 Kleinfelder Adaptation report. The WPCF plant perimeter wall was based on a preliminary evaluation estimate by Tighe & Bond in 2015. The raising of the electrical system is a very preliminary estimate as the engineering evaluation for this specific adaption measure has yet to be completed. The resiliency upgrade cost estimates total \$7.25 million dollars.

The WPCF upgrade projects, not including the resiliency upgrade projects or the UST replacement project, is currently estimated at \$13 million dollars. This estimate is very preliminary for most of the projects and will need to be refined as the actual design details are developed, the actual cost for some projects may be less and some could more than the amount shown. Some of the items estimated, such as the HVAC upgrades, are based on a preliminary design and cost estimate associated with the design. But, the HVAC cost estimate will change depending on the actual resiliency adaption measures that will ultimately be chosen for implementation, as well as specific unit process upgrades and modifications that are chosen for implementation. Many of the CIP needs for the WPCF were known prior to the development of this asset management tool, as they were identified over many years through many previous reports, many listed in Section 6. While some of these reports go back many years, many of these reports are the current reports and current condition assessments, including the W&C CIP recommendations from 2017. The asset risk grades for the WPCF assets were used in conjunction with these previous and current reports to develop the 5-year PLA.

We also recently evaluated "major" unit process changes that would raise the major treatment unit processes above the future flood zone and eliminate effluent pumping. The very conservative cost to do this extent of a major unit process upgrade was estimated to be in the \$40-50 million-dollar range. If the plant was designed from scratch today,

this would be a better alternative than the current design. Depending on the ultimate design period, it may be worth looking at a major unit process change at some point in the future, but at this point the cost was considered too high to implement. One notable outcome of this evaluation would be to understand the potential future considerations that could be needed as the planned detailed design of the process upgrades is done. For instance, one of the key items that was included in the major process evaluation was to replace the primary treatment process by eliminating the primary clarifiers and installing a rotary screen or rotary belt sieve primary treatment unit. This modification is one of the items included in the Process Upgrades project for consideration.

The WPCF PROCESS UPGRADES list includes the critical capital upgrades needed for the wastewater plant. The cost estimates will be refined as the specific repair, replacement and/or upgrade has yet to be determined or designed. Many of the details of the specific upgrades depend upon the ultimate adaptation measures, unit process upgrades, and on unknown conditions (buried piping, underground wiring, tanks structural integrity, etc.).

A summary of each WCPF capital project is as follows:

- **Disinfection system upgrade** – the hypo-chlorination system is over 20 years old, has worn-out tanks, piping, leaking containment area; temporary pumps, etc. The sodium bisulfite system is a temporary system that is not resilient and needs to be upgraded as well. These systems need to be totally rehabilitated or replaced with an alternative chemical system, such as PAA (Peracetic Acid).
- **Dump pit for Vector Truck** –As we increase our collection system Vector truck work, the amount of debris we remove from the collection system is increasing, and the impending closing of the Town landfill for debris disposal is a concern we would plan to address by having an efficient system to dump and concentrate (dewater debris) for off-site disposal.
- **Sludge system upgrade** – This work includes replacing or major overhaul of the 20-year-old Rotary sludge thickener, associated feed piping and pumps as well as modifying the underground septage tanks to be thickened sludge tanks as the above ground sludge tank has severe corrosion issues and is also not available for use in the winter due to freezing potential. This also interrelates with eliminating the primary clarifiers and the gravity thickeners, which is the current operation that has substantially reduced odor and corrosion issues.
- **HVAC upgrade** – the HVAC system design upgrade to replace the failed system was used as the basis for this project, with the caveat that some of the process upgrades under consideration will impact the specific rating for certain rooms or areas which will impact the final design details
- **Influent Pump Upgrade** – the influent pumps require rebuilding or replacing the pumps the suction and discharge piping (some piping is buried underground) & valves and related components to restore the pumping system capacity. Resiliency and process upgrades would impact the specific design upgrade details for these pumps (i.e., changing one or more of the pumps to dry pit submersible pumps which would not be damaged if the building flooded)
- **Process Upgrades** - Items included in the Process Upgrades include the following; Screening system, Grit system, Odor Control System, Primary treatment, Secondary Treatment, Plant Water system, Energy conservation measures. These items are interrelated and the final determination of specific upgrades will impact the overall cost estimates within this proposed project, as well as many of the other interrelated WPCF projects.
 - **Screening System:** the new influent screens have been preliminarily evaluated to modify these screens to an a finer ¼ inch screen and thereby increase the debris removal.
 - **Grit Removal:** the grit system is very old and requires continuous repairs and maintenance – plan is to evaluate abandoning the grit equipment and just scheduling a monthly or bi-monthly Vector truck cleaning of the grit chamber.

- **Odor Control System:** the odor control system is old and in need of repairs and upgrades and is located in the subbasement. Some upgrade options include replacement of the unit with a sea shell scrubber unit(s) located elsewhere – eliminates need for chemicals and sub-basement location
 - **Primary Treatment:** the primary clarifiers need total mechanical replacement, structural tank repairs, and piping/pump/gates upgrades and repairs. In lieu of refurbishing the existing units, we are evaluating a process change to eliminate the normal use of the primary clarifiers (which is the current operation) and implement a screen/sieve primary treatment system upgrade in lieu of the primary clarifiers; keep the primary clarifier tanks for peak flow management
 - **Secondary Treatment:** the secondary treatment system consists of a conventional activated sludge system and the tanks need some structural repairs (need a comprehensive internal tank structural assessment for each tank to determine the actual extend of repairs) and the associated mechanical systems, piping and gates need upgrades and repair. The aeration tank 2&4 needs are discussed below. The overall process modification would be to retrofit the system to use the MLE process (using the primary clarifiers as part of the activated sludge process) to enhance the overall process efficiency and capacity of the system. In addition, the gravity recycle of some or all the RAS to the plant influent would be reviewed for over process simplicity and energy conservation.
 - **Plant Water system:** the plant water system is in the sub-basement and was only partially rebuilt after the flood of 2013. It is the key asset for overall water conservation within the WPCF, and is a key asset as it provides cooling water for the generators and seal water for key pumps. The current location and system needs to be review and the system needs to be upgraded and replaced, and moving it out of the sub-basement to a more resilient location is to be evaluated. In addition, most on the hydrants and underground and building piping are severely corroded and many failures have occurred over the past couple of years.
 - **Energy conservation measures:** Energy conservation measures are integral with the evaluation and implementation of all process upgrade and further details are provided in Section 5.2.
- **Underground piping and assets at the WPCF** – there is considerable buried piping and wiring that has some history of failures due mainly to corrosion and wear and tear. Many of the pipelines have been on-line for 40 years and require internal inspections and condition assessments which will require by-pass pumping and similar measures to do the actual condition assessments and during any upgrade work. The estimated costs for this project are a place holder that will be adjusted as needed as more specific actual condition assessments are performed.
 - **Control Building Upgrades and Roof** – the Control Building has a long history of identified needs related to the deterioration of the building exterior, roof issues, interior structural issues, piping and plumbing issues, etc. The specific details of some of the items again will depend on the process upgrade decisions.
 - **Aeration Upgrade** –these two tanks have the original mechanical aerators that are 40 years old, the goal would be to install fine bubble aeration like what was installed in tanks 1 & 3 in 2002. There is also extensive wear and tear on in-tank piping, inlet and outlet valves and related components. The specific details of some of the items again will depend on the process upgrade decisions.
 - **RAS & WAS Pump Upgrades** – The RAS and WAS system components, pumps, piping, valves, etc., have shown severe deterioration over the past few years and long term major replacements and upgrades will be needed. The specific details of some of the items again will depend on the process upgrade decisions.

- **Effluent System Upgrade** - the effluent pumps require detailed condition assessments, but based on historical reports and data, the rebuilding or replacing the pumps and discharge piping (some piping is buried underground) & valves and related components will be needed to restore the pumping system capacity. Additional pumps or increasing the size of some of the current pumps also needs to be evaluated.
- **Controls Upgrade** - the SCADA system was partially upgraded from 2013 through 2016; it is anticipated that in about 5 years the system will need to be totally replaced. The specific details of some of the items again will depend on the process upgrade decisions.

The Pump Station upgrade projects are based on similar information as the WPCF projects, including the reports listed in section 6 and ongoing current condition assessment information. The specific items that will be upgraded will be impacted by the chosen resiliency adaption measures. Additional condition assessments will need to be completed, but the projects and associated costs estimates provide a base line for rehabilitating and upgrading the pump stations as needed for continued efficient operation and maintenance.

Table 4-2: Five-Year Capital Improvement Plan

Year	Description	Estimated Cost
2019	SSES Program (Flow Iso., CCTV, MH Inspect, Smoke Testing, Building Inspection)	\$925,000
2019	Electrical Upgrade - move system upstairs	\$1,500,000
2019	WPCF (Perimeter Wall OR Building/Site/Design improvements)	\$3,000,000
2019	Add pumping system to chlorine contact tank and outfall	\$1,000,000
2019	Pump Station resiliency measures - raise assets	\$1,750,000
2019	Disinfection system upgrade	\$400,000
2019	Vactor Dump Station	\$75,000
2019	Sludge System Upgrade	\$600,000
2019	HVAC Upgrade	\$1,500,000
2019	Influent pump upgrades	\$500,000
2019	Process Upgrades	\$5,000,000
2019	Underground piping and assets at the Wastewater Treatment Plant	\$600,000
2019	Control Building Upgrades and Roof	\$1,500,000
2020	Chemical feed system - PS 3	\$300,000
2020	Pump Station 3 Capital Upgrades	\$600,000
2020	Pump Station 4	\$400,000
2020	Aeration Upgrade - tanks 2 & 4	\$750,000
2021	Rehabilitation Contract I (Focus on I/I Removal and Structural Defects)	\$2,000,000
2021	RAS & WAS Pump Upgrades	\$150,000
2022	Pump Station 5 & 6	\$400,000
2022	Effluent System Upgrade	\$1,000,000
2022	Controls Upgrade - SCADA	\$500,000
	Total	\$24,450,000

4.1.3 Ten Year Plan

The following capital improvement strategies were recommended for implementation beyond the priority and 5 year plans, respectively.

Description	Estimated Cost
Rehabilitation Contract II (Gravity System)	\$2,000,000
Pump Station A, 1 & 9	\$600,000
Rehabilitation Contract III (FORCE MAIN - PS4, PS5, PS1 Rehabilitation)	\$1,200,000
Rehabilitation Contract III (Gravity System)	\$2,000,000
I/I Study (Metering Program, approx. 15 meters for 12 weeks)	\$230,000
Total	\$6,030,000

4.2 Funding Plan Tool

As part of the planning process, W&C met with Town decision makers to compile, review and approve a Funding Plan Development tool to demonstrate the effect of the above-mentioned Capital Improvement Plan on rate payers for the next five years. The project kick-off included gathering initial data such as:

- Past three annual Comprehensive Annual Financial Reports
- Three years of Sewer Operating results
- Summary of grant/loan funds received by Sewer Department
- Copies of consent decrees/binding agreements

This information was input into the Funding Plan Development tool to better understand the revenue generation success and/or limitations of the existing rate structure. As the Town of Hull operates a Sewer Utility Enterprise Fund, it was imperative to create an accurate account representation to project how future debts would be incurred.

The result was a rate planning tool in Excel that can be readily controlled by Town staff to consider various investment and rate scenarios. Memo outlining the tool and its components is included in Appendix G.

5 IMPLEMENTATION STRATEGY

This plan serves as the introduction to the Asset Management process, and it is expected to change over time. Therefore, the following recommendations serve as the next steps for implementation. This section reviews the software tools, and the expectation for updating condition assessments and asset inventory over time, as well as next steps for areas to investigate further.

5.1 Software Tools for Asset Management

Software can provide a platform for collaboration and advanced analysis to provide up-to-date, accurate, asset specific information. This method of information flow has evolved asset management decision making into a measurable process, allowing for optimization. Municipalities, such as the Town of Hull, are seizing the opportunity to increase the level of service while lowering costs by leveraging this type of software for optimization.

The Town of Hull and W&C have evaluated the readily available software options and selected to use a combination of Utility Cloud© and Innovyze's Info Master®. The software evaluation, attached as Appendix E, looked to find a solution that best incorporated mobile technology and spatial analysis. Mobile technology allows asset conditions to become updated in real time by field staff based upon maintenance activity. Spatial analysis can provide fast, complex visualization and analysis, system wide which allows for new levels of comparisons and insight. The sections below provide a brief description of each software, and generally how it is intended to be used.

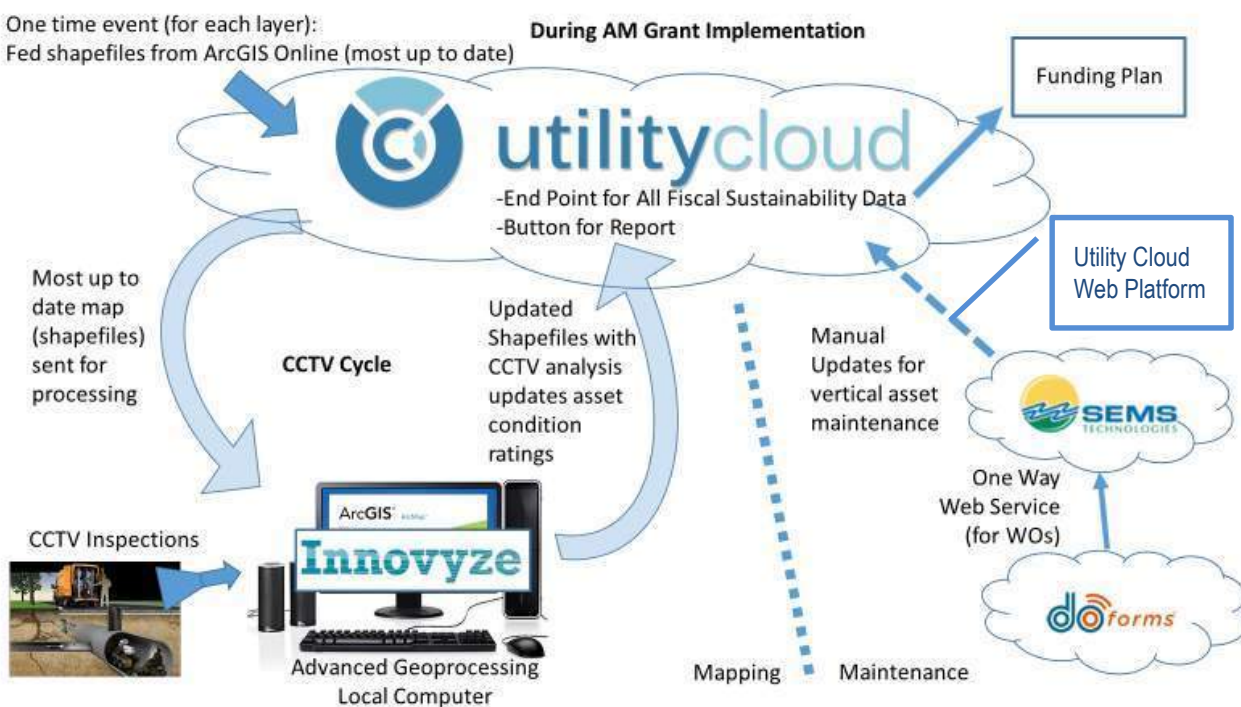


Figure 5-1: Software Integration Map

5.1.1 Utility Cloud©

Utility Cloud© is customizable cloud-based software that simplifies the process of tracking and visualizing assets, managing field operations, and sharing information. This software is a GIS based computerized maintenance management system (CMMS). The level of customization, and abilities to import, export, and direct interface with other systems give it the flexibility to act as an intersection of information. This software will act as the cornerstone for the asset management program. Utility Cloud© will:

1. Maintain the full list of assets, both for the WPCF and collection system,
Act as the repository for asset management data (likelihood of failure, consequence of failure, risk), and
Generate asset reports for comparison and evaluation

Staff will be able to review collection system assets as mapped assets. This provides relief of the need to rely on naming of very similar assets, like pipe and manholes. They will be able to use GPS to updated and continue to build out a complete and accurate asset inventory. Vertical assets, such as pump stations and the wastewater treatment facility, will also be navigated visually through a 'schematic' feature, where assets can be located on an image of a given room or area. This type of navigation also uses the concept of visualization to help clarify similar assets (pump 1 vs pump 2). Clear asset navigation helps lead to a better understanding of both what is missing and what is already included, leading to a better, complete asset inventory.

Utility Cloud© is an ideal repository for information from a variety of sources because of its customizable data structure and flexible importing and exporting features. The customizable data structure allows each asset and history event to be configured to retain data specific to that record, stored asset specific. This provides a place for all pertinent information in one place for easy review and decision making. All data types (asset and history records) can be quickly updated in bulk by importing excel tables, or in the case of assets, excel or shapefile. Both assets and history records can be exported, updated by outside sources (like Info Master®) and reimported, providing a smooth transition of data.

Utility Cloud© interfaces directly to Google Sheets™, an excel like web application, to create custom templates for powerful analysis. Once templates are created, users can generate reports through Utility Cloud© and get real time asset information without any additional updating.

As shown, Utility Cloud© will shine as an operational, day to day tool for managing assets, but for the purposes of assessing similar assets spread over a large area (horizontal assets), Utility Cloud© lacked some ability process information as efficiently as ArcGIS based products. Innovyze® Info Master® was selected to fill that gap.

5.1.2 Innovyze® Info Master®

Info Master® is a complete ArcGIS-based asset integrity management and capital planning software for water and wastewater networks. NASSCO PACP, MACP and Lateral Assessment Certification Program (LACP) certified, it leverages CCTV inspection data with existing GIS information with advanced modeling and sophisticated predictive analytics to give utilities a cost-effective business intelligence platform for more informed, action-oriented decision making.

A highly advanced and powerful analytical asset management tool, Info Master® uses state-of-the-art mathematical models to predict when a water or sewer pipes and manholes will fail, helping utilities determine the most cost-effective solution for avoiding or correcting the problem. In this way, users can ensure the best distribution of dollars spent on replacement and repair of underground assets.

Info Master® and Utility Cloud© have been designed to communicate through the shapefiles. Field collected data, such as new points or line, or updated conditions can be shared through shapefile spatial data and asset attributes.

5.2 Energy and Conservation Assessment

As recommended by MassDEP, an energy and conservation assessment is suggested for high eligibility for State Revolving Loan Funds. As a part of this Asset Management Plan, a brief evaluation was performed and is included in Appendix D. As part of this evaluation, we developed an equipment power estimate spreadsheet that assists in evaluating the individual processes and related equipment that use the most energy. Based on current processes and equipment currently being used, the following items were flagged as potential considerations for future upgrades and/or overall facility energy savings improvements:

- Aeration systems –
 - Fine bubble aeration for 2 aeration tanks [primary train – used >99 % of the time]
 - Mechanical aerators for 2 aeration tanks [backup train – used <1% of the time]
- Influent pumping system
- Effluent pumping system
- HVAC system – portions operate 24/7; current electrical unit heaters are main energy user during winter months
- Water conservation and plant water reuse system

Other systems that will be evaluated for energy efficiency would include:

- Return activated sludge system improvements/modifications
- Overall energy efficiency with regards to upgrading to high efficient LED lighting
- Pump station wet well aeration energy upgrades

Aeration system and the activated sludge process

The aeration system was upgraded in 2002 as part of the last major facility upgrade. Two of the four aeration tanks were upgraded to fine bubble aeration with DO control, and the other two aeration tanks have the original mechanical aerators. As part of our ongoing capital improvements program, we plan to replace the 2002 PLC that controls the aeration system with a new PLC that will allow for enhanced SCADA control over the current system. The current system is oversized [turndown capability of the aeration blowers is limited] for much of the operating time and the controls provide for limited on/off blower control, providing only partial DO control and energy savings. We plan to enhance the ability to provide DO and energy savings with the new PLC and SCADA control upgrade. We also plan to evaluate if the excess air from the existing blowers can be re-directed to other tanks/processes with the plant, which could allow for one or more other blowers to be turned off. We will also evaluate if a smaller blower should be added into the system to operate during times of less aeration demand.

We have already implemented a process change where we bypass the primary clarifiers and send influent directly to the aeration tank. This allows for the primary clarifier and the gravity thickener to be shutdown, saving energy by not having to run the units, as well as not having to provide plant water (dilution water) for the gravity thickeners. This also eliminates the need to pump primary sludge, primary scum and gravity thickener sludge. The major advantage of bypassing the primary/gravity thickener process is significantly reduced generation of Hydrogen Sulfide (H₂S). This not only reduces odors within the facility, it reduces air flow to the odor scrubber system, reduces chemical usage in the odor scrubber as well as the gravity thickener. Lower chemical usage also translates into less trucking of chemicals; less trucking is an overall energy benefit.

The other energy impact of bypassing the primary clarifiers is that it takes more aeration energy to treat the higher BOD load to the aeration system. Under the current conditions in Hull, since the aeration blowers are oversized, this

additional loading provides for a more efficient use of the aeration system. The waste sludge generated by the activated sludge process does increase due to the increased loading, but since this waste sludge (WAS) is now treated and processed via an existing aerated waste sludge tank, the production of H₂S is eliminated. The other benefit of processing the WAS is that it is thickened via a rotary sludge thickening (RST). The RST consistently produces 6-6.5 % solids. The gravity thickener produces only about 3.5 to 4% solids. So, the actual volume of sludge that needs to be trucked off site for ultimate disposal is reduced. Reduced trucking of sludge, as with reduced trucking of chemicals is an overall energy benefit.

As part of the future plant process upgrades we will evaluate options to enhance the current way we operate the plant, including using a rotary sieve process as an alternative to the current primary treatment process, as well as options to enhance the current activated sludge process, such as the MLE process. We will also be reviewing if the two aeration tanks that have the mechanical aerators should remain as backup units or be upgraded to the fine bubble aeration system.

Influent pumping system

The influent pumping system is the next major energy user. Maximizing the efficiency of the influent pumps and the pumping system, i.e., force mains, is the main goal. The function of the influent pumps is to pump the influent and plant recycle flows, after preliminary screening and grit removal, to the primary/secondary treatment process. There are five dry pit vertical pumps, 2 @ 20Hp and 3 @ 50Hp; all pumps are variable speed via VFDs. One or more of the influent pumps run 24 /7. Currently the two small 20 HP pumps use the 8-inch force main, and the three larger 50 HP pumps use a separate 16-inch force main. We performed pump efficiency testing of the influent pumping system and determined that the pump hydraulic efficiencies are lower than the design due to system wear and tear, on both the pumps and the force mains. A copy of the pump efficiency test report is included in Appendix D as well. Influent pump system efficiency upgrades being evaluated include:

- Rebuilding pumps with new impellers
- Coating impellers for improved hydraulic efficiency
- Installing higher efficiency motors
- Evaluating the condition of the 8 and 16 force mains, and then rehabilitating, if required
- Adding online pump pressure readings to the SCADA to allow for real time pump efficiency monitoring

When we rebuilt influent pump 5 in early 2016, we repaired and coated the impeller to try to improve reliability and well as hydraulic efficiency. This pump was not operational when we performed the pump efficiency testing in 2015, so we plan to perform additional pump efficiency testing in 2017. We also have enhanced our SCADA control of the pumps by connecting the VFDs to the SCADA system to allow for energy for each pump to be monitored. We have influent pump wet well level and flow meters on the 8 and 16-inch force mains. The next level of enhanced monitoring will be the pressure transducers noted above. Once the pressure transducers are in place, we will be able to use the SCADA system to continuously monitor pump efficiency in a manner like that provided in the pump efficiency test report in Appendix D. This will allow for improved reliability data for the O&M of the pump system as well as the ability to operate the system in the most energy efficient manner.

Effluent pump system

The effluent pump system is the next major energy user. Maximizing the efficiency of the effluent pumps and the effluent force main is the main goal. The function of the effluent pumps is to pump the treated secondary effluent to the chlorine contact tank for disinfection. There are four submersible pumps, 1 @ 20HP, 1 @ 35HP and 2 @ 60HP; all pumps are variable speed via VFDs. One or more of the effluent pumps run 24 /7. All four effluent pumps pump into one 16-inch force main.

We plan to perform pump efficiency testing of the effluent pumping system in 2017. The effluent pump system efficiency upgrades being evaluated include:

- Rebuilding pumps with new impellers
- Coating impellers for improved hydraulic efficiency
- Installing higher efficiency submersible pumps, when units need to be replaced
- Evaluating the condition of the effluent force main, and then rehabbing it to improve reliability and improve hydraulic efficiency, possibly by relining.
- Adding online pump pressure readings to the SCADA to allow for real time pump efficiency monitoring

HVAC system

The HVAC system is currently only partially functional, as many of the components were damaged from the plant flood that occurred in 2013. There are electric heaters and a few split heat pump systems that provide for partial heat and air conditioning. A major upgrade has been designed and includes bringing a six-inch natural gas line into the plant to allow for high efficiency heating to be installed. The plan moving forward will be to implement the HVAC upgrade in phases, as some of the process modifications, such as the primary sieve system mentioned above, could change the classification of certain rooms, which would impact HVAC details. Overall, the HVAC upgrade will provide for new high efficiency systems to be installed.

Water Conservation and Plant Water Reuse

The treatment facility has a plant water reuse system, comprised of two 25 HP pumps, that provides treated secondary effluent reuse water for many plant uses. This system is a critical asset, as it provides several key systems with water;

- Cooling water for the primary and backup up generators
- Influent pump seal water
- Odor scrubber makeup water
- Return and waste activated pumps seal water
- Gravity thickener dilution water
- Plant yard hydrants
- Service the spray for the secondary clarifiers
- Provide service water for the dichlorination system

The plant water control system was only partially repaired after the 2013 flood, as only manually controlled VFDs were installed on the plant water system. The plant water system needs to be upgraded with a new control panel and flow meter to allow for efficient automatic system monitoring and operation. In addition, the location of the plant water skid/pumps need to be evaluated as it relates to long term reliability and O&M. The plant water piping, both with the

control building and the plant pump stations, as well as the underground yard piping, needs to be evaluated and much of it needs to be replaced or upgraded. The plant water system is a key asset for water conservation and reuse, and it reduces the use of potable water for the treatment facility.

Return activated sludge system improvements/modifications

The RAS pumping system consists of three pumps @ 20 HP each, each with VFD controls, and typically one pump operates 24/7; during peak flow events, when a 2nd secondary clarifier is put on line, two pumps operate 24/7. All three pumps have recently been upgraded and rebuilt. As the pumps are rebuilt to restore hydraulic efficiency, the motors have been upgraded with higher efficiency motors. We are currently finishing the rebuild of the 3rd pump and will be installing a high efficiency motor on that unit. As part of a longer-term process evaluation, we will look to allow the return activated sludge to flow to the influent sewer or headworks via gravity and use a control valve for flow control. This would allow for the RAS pumps to be shut down most the time. The RAS flow would become part of the influent flow, potentially saving energy by taking advantage of the influent pump system operation.

Overall energy efficiency with regards to upgrading to high efficient LED lighting

As part of future plant upgrades, we will evaluate switching to more energy efficient LED lighting.

Pump Station Wet Well Aeration Energy Upgrades

We have recently installed wet well aeration systems in all the wastewater pump stations. These aeration systems have reduced debris build up in the wet wells, reduced the impact of FOG in the wet wells and the collection system, and provided for oxygen addition into the collection system. The initial first year of operation of these aerators proved that they are beneficial. We are now in the evaluation process with the manufacturer to determine if solar power can be added to the pump stations to power these aerators, as part of our overall energy efficiency improvements.

As we move forward with the detailed design of treatment plant unit process improvements, we will evaluate additional energy efficiency options. Our energy efficiency program as described above is also a part of our Corrective Action Plan for the Administrative Order on Consent.

1.2 Resiliency and Adaptation Planning

The Town of Hull is considering many different adaptation options to reduce the consequences from storm related surges, flooding and high flows, related to rising sea levels and increased intensity of storm/rain events. This is a key component for consideration as part of the wastewater system long term capital plan. In June 2016, the Town of Hull released its Coastal Climate Change Vulnerability Assessment and Adaptation Study, which made high-level adaptation recommendations for many of the Town's assets, including the wastewater treatment facility and several pump stations.

During a similar timeframe, from December 2015 to March 2017, the Town of Hull engaged in a series of webinars and an in-person meeting to conduct a climate change risk assessment using the U.S. Environmental Protection Agency's (EPA) Climate Resilience Evaluation and Awareness Tool (CREAT) to understand wastewater system vulnerabilities to climate change impacts. A preliminary CREAT report provided some initial evaluation of several adaptation options (see full report in Appendix F).

Some of the options that were preliminarily reviewed include; constructing a wall around the WPCF to protect the plant assets from flooding; building a permanent bypass for peak flows; modifying the WPCF to be a headworks facility and connecting to the Deer Island Sewage Treatment Plant operated by the Massachusetts Water Resources Authority (MWRA); evaluating treatment plant process upgrades that included raising major unit processes out of the flood zone,

and performing various adaption measures at several pump stations. These adaptation options have various degrees of cost effectiveness when comparing the cost of implementing the options with their potential risk reduction benefits.

The actual adaptation measures to be implemented have not yet been finalized. The MWRA option has been removed from the table due to an unfavorable response from the MWRA, coupled with an extremely costly capital outlay to build a connection into the MRWA system. The other resiliency adaptation measures will be further vetted as part of future engineering design work.

Currently, the Town of Hull has submitted a Coastal Resilience Grant application to the Massachusetts Office of Coastal Zone Management (CZM) for one of the recommended improvements, and the Sewer Department has already began investing in some immediate capital upgrades to mitigate some of the WPCF. The CREAT tool is one of the future methods/tools the town can use to assist in trying to determine which adaption measures would be recommended for implementation.

To continue to use the model and to best assess adaptation impacts, the following next steps are needed:

- Incorporate new, and refine further existing adaptation options in CREAT file.
- Incorporate Collection and Treated Wastewater Conveyance System adaptation measures.
- Incorporate more accurate costs based on ongoing engineering design

6 REFERENCES

Various report and documents were used to assist in developing the asset condition assessments and developing the list of capital plan recommendations; including, but not limited to the following:

Dec. 1983 – Evaluation of Sewage Facilities for Hull, MA – Black & Veatch

1995 - Wrestling with High Storm Tides at the Hull Water Pollution Control Facility

1996 – Heating, Ventilation and Air Conditioning System Study – William H. Rowe Associates

1998 - Tighe & Bond Project Evaluation Report

1989 - Metcalf & Eddy Design Criteria for Deer Island Storm Surge ...

March 1999 Tighe & Bond Memo – Sewage Pump Station Inspections

September 2004 Process Energy Services, LLC Energy Plan for Hull Wastewater Facility

April 2005, Basis of Design Report for Pump Station Upgrades, Hull, MA - Aquarion Engineering Services

March 2008 Wight-Pierce Hull WWTP Operational Assessment

2014 Woodard & Curran Contract Operations Proposal

June 15, 2015 EPA and DEP inspection reports

September 24, 2015 W&C Capital Planning & Godwin Pump Setup - Meeting Notes

November 6, 2015 Hazard Mitigation Grant Program Recommendations – Tighe & Bond

June 2016 Coastal Climate Change Vulnerability Assessment and Adaptation Study, Tow Hull, MA – Kleinfelder

2017 – Tighe & Bond HVAC design and opinion of Probable Construction Cost

2017 Woodard & Curran Capital Improvement Spreadsheet (update from 2015 and 2016 versions)

Various W&C Condition Assessment reports:

- 2015 Electrical System Maintenance shutdown for main switch board, ATs, preventative maintenance and testing & INFRARED testing report
- 2015 electrical system ARC FLASH Analysis
- 2015 Vibration analysis report for key WPCF equipment
- 2015 Influent Pump Efficiency testing report
- 2015 SCADA system overall condition assessment
- 2017 Structural inspection reports – WPCF and PS 3 and PS 4
- 2017 UST options evaluation memo
- 2015-2017 Various W&C “open” corrective maintenance work orders

APPENDIX C: SEWER OVERFLOW EMERGENCY RESPONSE PLAN



Appendices Not Included

980 Washington Street, Suite 325
Dedham, MA 02026
800-446-5518

woodardcurran.com
COMMITMENT & INTEGRITY DRIVE RESULTS

Emergency Response Plan

For Sanitary Sewer
Overflows

217319
Town of Hull, MA
August 2016

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APPENDICES

Appendix A:	SSO Notification Procedure and MassDEP Forms
Appendix B:	Town Public Notification Sources
Appendix C:	Example Letter for Property Owner Relief
Appendix D:	WWTF Emergency Contact List
Appendix E:	List of Approved Sewer Installers

INTRODUCTION

Woodard & Curran holds a professional services contract for the operation and maintenance of the water pollution control facilities for the Town of Hull. Woodard & Curran (Contractor) began operation of the Hull WWTF facility on April 1, 2015.

Woodard & Curran has prepared this Emergency Response Plan (ERP) to serve as a reference guide for the Town of Hull's Wastewater System. The purpose is to document and improve procedures for responding to Sanitary Sewer Overflows (SSO's) and to meet the requirements set forth by the Administrative Order on Consent (AOC). This ERP provides standard procedures for personnel to follow in the event of an SSO.

The objectives of this ERP are to:

- minimize the volume and impact of the untreated wastewater discharged to the environment;
- establish procedures to respond and stop SSOs as rapidly as possible;
- ensure appropriate mitigation measures are employed;
- prevent the recurrence of SSOs at the same location; and
- protect the safety of the public and personnel

To achieve these objectives, this ERP divides SSO response into 12 sections:

- a. An Emergency 24-hour Telephone Number
- b. Procedure to Publicize Unauthorized Discharges
- c. Procedure to Provide Oral Notice of Unauthorized Discharges
- d. Procedure of Public Awareness from Unauthorized Discharges
- e. Procedure of Rapid Dispatch from Unauthorized Discharges
- f. Procedure for Minimizing & Mitigating Unauthorized Discharges
- g. Procedure to Provide Relief of Unauthorized Discharges
- h. Procedure for Clean Up of Unauthorized Discharges
- i. Procedure of Documentation of Unauthorized Discharges
- j. Procedure for Preparedness of Unauthorized Discharges
- k. Procedure of Periodic Reviews of ERP
- l. Provisions for Safety Training

EMERGENCY RESPONSE PLAN PROCEDURES

Sanitary sewer overflows (SSOs) are the result of a failure in the sewer collection system. SSOs can be caused by such things as structural pipe failures, clogged pipes, or hydraulic deficiencies. SSOs have significant consequences including threatening public health, expense of mitigation, potential regulatory action, and damage to the Town's reputation. Preventing SSOs is the primary goal of the asset management and capital improvement process. However, in the event that an SSO does take place, it is crucial to have a plan in place for effectively responding to the overflow in the field. An effective response will help to reduce the consequence of the SSO event.

A. EMERGENCY 24-HOUR TELEPHONE NUMBER

In the event of an SSO, the Town of Hull would like residents and employees to contact the Sewer Department during regular business hours, or the Hull WWTF Emergency Beeper line outside of regular business hours, to report any unauthorized discharges. By contacting these numbers, an employee of the Hull WWTF will be notified and the process for dispatch, investigation, mitigation and reporting will be initiated.

During Regular Business Hours	Outside of Business Hours (24-hours)
Sewer Department Office: (781)-925-1207	Hull WWTF Emergency Beeper: (781)-226-1494

Both of these numbers are advertised on the Town of Hull Sewer Department website, at the bottom of Sewer Bills sent to residents, in the "Down the Drain" Newsletter provided in as a billing insert and on magnets distributed by the Sewer Department. See Appendix B for examples of these notification formats.

B. PUBLICIZING UNAUTHORIZED DISCHARGES

In the event of a very large unauthorized discharge, where for public health and safety concerns an alert is to be made, the town wide notification system will be used to disseminate information appropriately. CodeRed®, the service provided by Town of Hull vendor Emergency Communications Network®, is used to call, text and email users in proximity of the site.

The application utilizes user-input geographic areas to alert cell phones within the area (including residents and visitors) of the emergency situation. Residents can also utilize the free mobile application, CodeRed® Mobile Alert®, which can be downloaded for free from the Apple store, or Google Play. Residents can sign up for the alerts using the Town of Hull Access Site (<https://public.coderedweb.com/cne/en-US/BF63594E6F4A>)

As a part of any spill notifications to the public, the app will encourage residents to contact emergency services or the Hull WWTF Emergency Beeper for any additional spills or concerns regarding the discharge situation. Depending on the mitigation strategy, information may also be posted on the Town of Hull Sewer Department website (http://www.town.hull.ma.us/Public_Documents/HullMA_Sewer/homepage) or on the Town of Hull Emergency Management Facebook page (<https://www.facebook.com/Town-of-Hull-Emergency-Management-190450881031795/>).

The above listed public notifications will be made at the discretion of the Town of Hull Town Manager or Emergency Preparedness Committee in cooperation with Contractor Personnel.

C. PROVIDING IMMEDIATE NOTICE OF UNAUTHORIZED DISCHARGES

The following situations require notification to MassDEP and submittal of the SSO Report Form:

- An un-permitted overflow or bypass;
- Backup of wastewater into public or private property when the event is caused by a condition of the system owned and operated by the sewer authority

Backups of wastewater into a property which are not caused by conditions in the system owned and operated by the sewer system are not required to be reported. These incidents normally occur due to blockages in service connections to a property or blockages in the internal plumbing system.

In the event of an unauthorized discharge, an email or telephone call is to be made within 24-hours of discovering the release and the written report is to be submitted within 5 days. For Town of Hull WWTF, the Project Manager provides notice via email (and telephone call, if necessary) to the following department liaisons:

- MassDEP: Water Resources Contacts-Sewers-Combined Sewer Overflows-Southeast Region Agent
- EPA: Region 1 Contact
- Hull Board of Health: Public Health Director
- Hull Public Works: Department of Public Works Director or Asst. Director

If a release has directly impacted nearby waterbodies or wetland resources, then the following parties are to be notified based on discharge scope and Project Manager discretion:

- Massachusetts Division of Marine Fisheries
- Town of Hull Harbormaster/Shellfish Warden
- Town of Hull Conservation Agent

Refer to Appendix A for specific MassDEP instructions for reporting and Appendix D for the current WWTF Emergency contact list.

D. PUBLIC AWARENESS OF UNAUTHORIZED DISCHARGES

In the event of a very large unauthorized discharge, where for public health and safety concerns an alert is to be made, the CodeRed® town-wide notification system will be used to disseminate information appropriately. Administration of the Town-wide CodeRed® System will be enacted at the discretion of the Town of Hull Town Manager and/or Emergency Preparedness Committee.

E. RAPID DISPATCH OF UNAUTHORIZED DISCHARGES

An effective response to an emergency begins well before an event occurs. This section describes equipment, team considerations and methods to assess and secure a site to ensure a timely response to SSO's.

Equipment

Having the right equipment on hand is essential to a rapid and effective response. Inspect all ERP equipment quarterly or as required by manufacturer. Replace any damaged, missing, or expired equipment immediately. Make sure

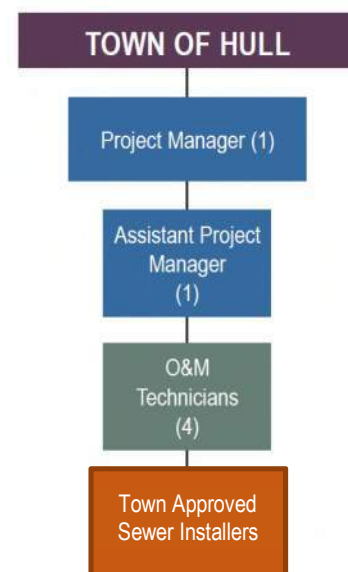
equipment is easily accessible and that the team knows how to use equipment and where to find it. Coordinate with the Highway Department in the case that Highway Division equipment is needed for this ERP.

- Standard PPE: traffic vests, high-vis coveralls, sharps-proof gloves, disposable nitrile gloves, work gloves, safety glasses and goggles, hard hats, steel-toed boots.
- Confined space entry equipment: hoist, harnesses, and gas meters.
- Site safety/control: cones, barrels, tape, construction fence, temporary signs, electronic signs (optional), portable light tower.
- Communication equipment: cell phones, tablets, and radios. The plant has a radio base station which communicates with the DPW Sewer Administration Staff and the Assistant DPW Director.
- Bypass pumping equipment: portable bypass pumping equipment, spare fuel, at least 50 feet of suction hose and 300 feet of lay flat hose, plus spare sections of each.
- Containment equipment: sandbags and sand, 100 feet of debris boom sufficient for spanning small streams or surrounding spills.
- Cleaning equipment: Subcontractor for jetter/pump truck for push camera or CCTV truck.
- Disinfection equipment: Lime is used to avoid harm to the environment. The chemical should be spread by scoop or fertilizer spreader. Refer to the Safety Data Sheet (SDS) and wear proper personal protective equipment (PPE) when using it.
- Additional heavy equipment for repairs requiring excavation: The Contractor relies on approved subcontractors to perform any major excavation work. Table in Appendix E below shows approved list of subcontractors available for sewer related work in the Town of Hull (as provided by the Town of Hull Sewer Department).

Team Considerations

The Contractor has the following team in place that is prepared to mobilize and respond to SSOs. Contractor employees are trained sufficiently to fulfill multiple roles on the response team. The roles in the team are listed below:

- Project Manager: The Project Manager is responsible for ensuring that the procedure is followed correctly, and the crew's actions comply with DEP and EPA regulation. The Project Manager would also be responsible for performing the 24-hour notification, and submitting the full report to the DEP and EPA.
- Assistant Project Manager: The Assistant Project Manager is trained in assessing and identifying hazards on site. They are responsible for making sure that the crew is taking appropriate precautions. They are also responsible for establishing safety perimeters and traffic control.
- O&M Technicians: The O&M technicians are trained in using DoForms, and serve as first responders to observe, assess and report the SSO accurately and promptly. O&M technicians also serve as the front line for site security and remediation measures, at the direction of Assistant Project Manager and Project Manager.



- Town Approved Sewer Installers: The Contractor relies on approved subcontractors to perform any major excavation work. Table in Appendix E below shows approved list of subcontractors insured and approved for sewer related work in the Town of Hull (as provided by the Town of Hull Sewer Department).

The Project Manager will be responsible for assembling the team and identifying roles. During smaller overflow events, several of these roles can be taken on by one crew member. All crew members are to be properly trained for any role on the response team they are expected to fulfill. The SSO response team should consist of a minimum of two employees: Depending on the severity of the SSO event, the Project Manager will decide how many staff people are needed to contain and stop the overflow.

Assessment and Site Security

After the Sewer Department and WWTF Personnel have been notified, the Project Manager will dispatch the crew immediately to the problem location. Once on site, assess the immediate danger to public health or the environment by prioritization. Identify which measures should be addressed first and which can wait. In general, the first priority of the operation should be to protect the safety of public and employees, and the second priority to protect the environment and property. Here are some examples of prioritization:

- If the SSO appears to be caused by a collapsed pipe or another condition that will take time to repair, establishing bypass pumping to stop the overflow should be a first priority.
- If the SSO poses minimal risk to health or the environment, for example if it can be easily directed into a combined sewer catch basin or sewer manhole, fixing the problem should take priority.
- If the overflow is in a busy street, setting up traffic control, and using Town of Hull Police Department if necessary to protect workers and the public should be the first priority.

Next, the site is to be secured immediately by setting up a perimeter and traffic control to protect the public and personnel. Cordon-off areas of ponded or flowing sewage to prevent public contact. Then, determine if additional manpower will be needed. For most small events, a crew of two or three is sufficient. For larger, more complicated events, multiple teams may be needed to work on different tasks simultaneously such as cleaning or repairing the sewer, establishing bypass pumping, controlling traffic, and/or containing the spill.

Photos should be taken, using phone or tablet, throughout the process to show the source, the spill and cleanup measures taken. For example, once the location of the blockage/failure is confirmed (by inspecting manholes downstream or other methods), photos of the confirmed infrastructure source and GPS coordinates should be recorded using the DoForms application on tablet or phone.

Finally, corrective action is to be taken at the direction of the Project Manager and crew. Prior to application, the Project Manager or other designated assistant Project Manager, will brief the crew on potential hazards and required precautions.

In the event of a backup onto private property, flush between manholes to ensure that the collection line is clear. If manholes are found to be free-flowing, then the backup is due to an issue with the lateral, which is the responsibility of the Property Owner. Inform them that it is their responsibility to have their lateral cleaned and inspected.

F. MINIMIZING & MITIGATING UNAUTHORIZED DISCHARGES

If it is apparent that the SSO cannot be stopped or contained quickly, set up pump equipment and hoses from the upstream manhole to the nearest flowing manhole below the blockage. Use a pump truck to remove as much sewage as possible until pumping is established.

Use the necessary equipment to relieve the blockage, typically either by jet flushing up toward the blockage from the first free-flowing downstream manhole. When feasible, set up a trap and/or vacuum hose in the downstream manhole to catch debris. Work from the surface and avoid entering the manhole if possible.

Remove the debris from the sewer pipe or manhole. Examine the debris for clues to determine the cause of the blockage. Record information about potential causes of the blockage using the comments field in the SSO DoForm and also make new work order forms as necessary to perform maintenance on the affected infrastructure concerns.

G. PROVIDING RELIEF FROM UNAUTHORIZED DISCHARGES

In the event of unauthorized discharges experienced from the collection system by residents of private property, relief may be provided as needed. Homeowners are informed to call the Sewer Department office first, if they experience a backup, and to check the street prior to calling a contractor. This information is noted on the sewer invoice, as well as on the “Down the Drain” newsletter including in billing mailings. The procedure for applying for relief is outlined below, and an example letter is included in Appendix C.

Steps for Homeowner Relief:

1. Call is received at the sewer plant regarding sewage back up.
2. The Contract Operator is notified by Town Personnel that there is an issue to be investigated.
3. The Contract Operator follows SSO investigation procedures (i.e. determines if issue is related to the sewer main by assessing upstream/downstream manholes).
 - If the issue is determined to be caused by a problem in the street line, the homeowner contacts a contractor to perform the clean-up.
4. Homeowner pays contractor and then submits a copy of the invoice to the Sewer Department.
5. The Town Facility Manager reviews the request and approves payment to the homeowner.
6. The homeowner receives a letter from the Town Facility Manager stating that the backup was reviewed and determined to be an issue with the street line.
7. A check is provided to the homeowner to reimburse them for the cost that they incurred.

H. CLEAN-UP OF UNAUTHORIZED DISCHARGES

1. Use the Vacuum truck or pump to collect as much of any ponded sewage as possible and discharge to combined or sanitary sewer.
2. Use street sweeper, brooms, and/or Vacuum truck to remove sewage-related debris and organic matter from the affected area. Avoid handling debris: use sharps-proof gloves if handling is necessary.
3. Disinfect area as required. With PPE, spread lime with a scoop or spreader.
4. Flush the area with additional clean water. Use sandbags, Vacuum truck, pumps and/or other means to contain and collect flushing water and direct it to the nearest sanitary sewer.
5. If the wastewater jeopardizes a park or other public facility, restrict public access until the issue has been remedied to the satisfaction of the local board of health.
6. Provide signage as required to notify the public of any remaining public health issue. If signage is not sufficient to properly notify the public using procedures outlined in Section D.

I. DOCUMENTATION OF UNAUTHORIZED DISCHARGES

MassDEP and EPA must be notified within 24 hours that an SSO has occurred. A full report using the MassDEP form must be submitted within 5 days. The MassDEP form can be found on their website: <http://www.mass.gov/eea/agencies/massdep/service/approvals/sanitary-sewer-overflow-bypass-backup-notification.html> and is included in Appendix A.

The Contractor has a standard operating procedure in place for reporting SSOs using DoForms, an application for data collection. The O&M technician who investigates the SSO starts the procedure in the field, then the Project Manager reviews and submits the reports to the compliance agencies. The DoForm includes all of the required fields, so that the field staff can quickly and easily fill out all the necessary information (see screenshots listed in Appendix A). In the event of error with DoForms, the MassDEP notification form is to be filled out by hand and attachments included in hard copy form (see complete form also attached in Appendix A).

Backups caused by property-owners are not reported to MassDEP and EPA. Backup from the collection system into or onto private property are required to be reported to MassDEP and EPA.

J. PREPAREDNESS OF UNAUTHORIZED DISCHARGES

In order to ensure preparedness of response a mock SSO drill should be conducted annually to prepare crews, in addition to the annual safety training procedures listed under Section L. By performing an annual SSO drill, the updates to the Emergency Response Plan can be modified as needed.

K. PERIODIC REVIEW OF EMERGENCY RESPONSE PLAN

This document was last updated for this report and will be evaluated annually for correctness or when operational changes are made at the plant. At a minimum, the Emergency Response Plan will be reviewed once annually, during a practice SSO drill.

L. PROVISIONS FOR SAFETY TRAINING FOR WOODARD & CURRAN PERSONNEL

Everyone on the response team should have appropriate and up-to-date safety training. Recommended safety trainings include but are not limited to:

- Equipment operation
- Process Control
- Energy and Chemical Conservation
- Maintenance and Repair
- CPR/First Aid
- Confined Space
- Emergency Response,
- Hazardous Material Handling
- Right-to-Know laws

In addition, Contractor shall provide training at least once annually with first responder training in conjunction with Hull's Fire & Rescue and Police Departments regarding chemicals, situations, confined spaces, and other conditions that might pertain to worker and/or public safety. Other representatives of the Town may attend training sessions at no cost to the Town upon request. Contractor shall provide ample notification of the training sessions to ensure that Town representatives may attend.



Appendices Not Included

APPENDIX D: KEY CONTACT LIST

TOWN OF HULL WPCF EMERGENCY CONTACT LIST

CONTACT	DEPARTMENT	TITLE	OFFICE	CELL
MAIN OFFICE	DPW OFFICE	PHONE LINE	(781) 925 0900	N/A
JIM DOW	DPW	DIRECTOR	(781) 740 8310	(781) 738 2518
JOHN STRUZZIERY	DPW/SEWER DEPARTMENT	ASS'T DIRECTOR/DIRECTOR	(781) 925-1207	(781) 738-7853
CHRIS GARDNER	DPW	FOREMAN	(781) 740 8310	(781) 206 1885
MARY ELLEN WHITE	DPW	OFFICE ADMIN	(781) 925 0711	(617) 733 0106
ON CALL PERSON	DPW		(781) 630 0110	
JOYCE SULLIVAN	BOARD OF HEALTH		(781) 925 2224	(617) 872 5575
PETER LOMBARDO	BUILDING DEPARTMENT		(781) 925 1330	
CHRIS KRAHFORST	CONSERVATION		(781) 925 8102	
KURT BORNHEIM	HARBOR MASTER		(781) 925 0316	
DICK MILLER	HULL LIGHT		(781) 925 0051	(339) 236 1160
PAT CANNON	WIRING INSPECTOR		(781) 925 1330	(339) 788 1104
EMERGENCY CONTACTS	Town of Hull		OFFICE	
HULL POLICE	DISPATCH		(781) 925 1212	
HULL FIRE	DISPATCH		(781) 925 2424	
EMERGENCY MANAGEMNT			(781) 925 8111	
REPORTING AGENCIES	DEPARTMENT	CONTACT	OFFICE	
MASS DEP	SOUTHEAST REGION	DAVE BURNS	(508) 946 2738	
EPA	BOSTON	DAVID TURIN	(617) 918 1598	
DIV. OF MARINE FISHERIES	ANNISQUAM RIVER STATION	RYAN JOYCE	978-282-0308 ext. 171	
TOWN ENGINEERS		CONTACT	OFFICE	CELL
TIGHE & BOND		MIKE SCHRADER	(508) 564 7285	(978) 761 6380
KLEINFELDER		MIKE CUNNINGHAM	(617) 497 7800	(617) 498 4773

WASTEWATER TREATMENT	WOODARD & CURRAN	CONTACT	OFFICE	FAX
OFFICE	WWTP	Line #1	(781) 738 2518	(781) 925 3056
STAFF	W&C	CONTACT	COMPANY CELL	PRIVATE CELL
AREA MANGER	W&C	FRANK CAVALERI	617-590-4571	
ASST. AREA MANAGER	W&C	ROB SCOTT	860-204-7988	
PROJECT MANAGER	W&C	ARAM VARJABEDIAN	339-214-8334	774-260-0897
ASST. PROJECT MGR	W&C	BILL BOORNAZIAN	603-651-8773	
EMERGENCY ON CALL	W&C	ON CALL PAGER	339-236-0249	
O&M TECH 2	W&C	JOE BASLER	339-214-8332	781-974-3049
O&M TECH 2	W&C	RICK CLARK	339-214-8331	
O&M TECH 1	W&C	ERIC SUTTON	339-214-8330	781-956-9893
OPER TRAINEE	W&C			
PART TIME OPERATOR	W&C	PAT OWENS		508-517-0455
Engineer/Operator	W&C	KATE ROOSA	339-205-8965	
SUPPORT STAFF	W&C	CONTACT	COMPANY CELL	PRIVATE CELL
SR OPERATIONS SPECIALISTS	W&C	JIM GAGLIARD	781-752 5615	
SR OPERATIONS SPECIALISTS	W&C	JODY ST.GEORGE	508-922-1599	
Corporate Health & Safety	W&C	Shannon Eyler	207-807-0713	
Electrician / Manager	W&C	Mark Cleary	617-279-5740	
SCADA Engineer	W&C	Steve Rose	508-280-6092	
SCADA Engineer	W&C	Bob Amaral	508-280-5901	
On Call SCADA Engineer	W&C	ON CALL ENGINEER	1-800-MYSCADA	
Operator	W&C	Dick Gould	617-279-5741	
Operator	W&C	Ray Mott	860-486-7171	
Operator	W&C	Bob Rowland	617-756-1934	
Operator	W&C	Ken Boughter	617-279-5743	
Operator	W&C	Joe Vento	617-451-2695	
Engineer/Operator	W&C	Josh Jondro, P.E.	617-407-7970	
TECHNOLOGY MANAGER	W&C	Alan Fabiano	914-456-3115	
TECHNOLOGY ASST. MGR.	W&C	Andy Crawford		
O&M MIS Manager	W&C	Jeannie Dubois	860-605-0358	
SERVICE PROVIDER	CONTRACTOR	CONTACT	OFFICE	CELL
Electrician	Electrician	Andy Mckenzie		781-589-5622
General Contractor	WATERLINE	Mike Czepiel	(603) 474-7477	
General Contractor	HUB CONSTRUCTION	Paul Gratta	(781) 925-3766	(617) 719 0926
General Contractor	DIVITO CONSTRUCTION	JOE DIVITO		(781) 622 8605
Jetter/vacuum truck	SEWER TECH		(781) 878-0636	
Jetter/vacuum truck	Wind River Env.		877-914-1926	
Millwright/Mechanic	Lydon		(508) 897-1700	
General Contractor	Pride Environmental	Scott Gambrazzio	508-880-6009	
By-pass Pump & Sludge	JP Noonan	Jim Beird	800-922-8026	
By-pass Pump & Sludge	Wind River Env.		877-914-1926	
By-pass Pump & Sludge	Soares		508-824-8370	
By-PassPumping	Godwin Pumps		856-467-3636	
By-PassPumping	BakerCorp.		800-BAKER 12	
By-PassPumping	Thompson Pumps		800-767-7310	
By-PassPumping	Rain-For-Rent		800-742-7246	
UTILITIES	SERVICE PROVIDER		OFFICE	
Phone lines	Verizon		800-769-4656	
Power	Hull Municipal Light Plant		781-925-0051	
Natural Gas	National Grid		800-233-5325	

APPENDIX E: TOWN SEWER USE ORDINANCE (SUO)

SEWERS

Chapter 149

Sewers¹

Article I Sewer Use

- § 149-1 Definitions and word usage.
 - § 149-2 Permit required for connection; notice of changes in discharge.
 - § 149-3 Building sewer permit classes; applications and fees.
 - § 149-4 Responsibility of owner.
 - § 149-5 Separate building sewers required; exception.
 - § 149-6 Use of old building sewers.
 - § 149-7 Conformance required.
 - § 149-8 Underground connections.
 - § 149-9 Prohibited connections.
 - § 149-10 Notice to inspect and connect.
 - § 149-11 Guarding of excavations
 - § 149-12 Time limit for connection.
 - § 149-13 Licensing of persons making connections.
 - § 149-14 Connections required
 - § 149-15 Authority of Permanent Sewer Commission
 - § 149-16 Prohibited discharge to sanitary sewer.
 - § 149-17 Discharge of stormwater and drainage.
 - § 149-18 Prohibited discharge to any public sewer.
 - § 149-19 Restricted discharges.
-

¹ Editor's Note: The Permanent Sewer Commission was created 10/17/67 STM, Article 5, and extended under Article 38 of the 1969 Annual Town Meeting. Provisions concerning said Commission are on file in the Town Hall.

HULL CODE

- § 149-20 Interceptors.
- § 149-21 Maintenance of facilities by owner.
- § 149-22 Control manholes.
- § 149-23 Measurements, tests and analyses.
- § 149-24 Special agreements.
- § 149-25 Damage to system.
- § 149-26 Powers and authority of inspectors.
- § 149-27 User charge system.
- § 149-28 Violations and penalties.
- § 149-29 Exemptions.

Article II Connections to Building Sewer

- § 149-30 Definitions.
- § 149-31 Connection required.
- § 149-32 Exemptions.
- § 149-33 Violations and penalties.
- § 149-34 Additional remedies.
- § 149-35 Enforcement.

Article III Additional Charges

- § 149-36 Interest.
- § 149-37 Demand charge.

Article IV Sewer Rehabilitation Fund

- § 149-38 Preamble.
- § 149-39 Creation; purpose.
- § 149-40 Payments; exceptions
- § 149-41 Equal dwelling unit system; charge per unit
- § 149-42 When payment due.
- § 149-43 Rules and Regulations.

(HISTORY: Adopted: Article I, 4/7/75 Annual Town Meeting; Article II, 4/8/85 Annual Town Meeting, Art. 26; Article III, 1/27/86 Special Town Meeting, Article 16, and 10/26/87 Special Town Meeting, Article 21; Article IV, 10/26/87 Special Town Meeting, Article 32. Amendment noted where applicable.)

GENERAL REFERENCES

Housing standards – See Chapter 113.
Street and sidewalks – See Chapter 155.

ARTICLE I

Sewer Use

(Adopted 4/7/75 ATM)

§ 149-1 Definitions and word usage.

- A. Unless the context specifically indicates otherwise, the meaning of terms used in these rules and regulations shall be as follows:

BOD (denoting “biochemical oxygen demand”) – The quantity of oxygen utilities in the biochemical oxidation of organic matter under standard laboratory procedure in 5 (five) days at twenty degrees Celsius (20C.), expressed in milligrams per liter.

BUILDING DRAIN – That part of the lowest horizontal piping of a drainage system which receives the discharge from soil, waste and other drainage pipes inside the walls of the building and conveys it to the building sewer, beginning five (5) feet (one and five tenths (1.5) meters) outside the inner face of the building wall.

BUILDING SEWER – The extension from the building drain to the public sewer or other place of disposal.

COMBINED SEWER – A sewer receiving both surface runoff and sewage.

COMMISSION – The Permanent Sewer Commission of the Town of Hull.

GARBAGE – Solid wastes from the domestic and commercial preparation, cooking and dispensing of food, and from the handling, storage and sale of produce.

INDUSTRIAL WASTE – The liquid wastes from industrial manufacturing processes, trade or business as distinct from sanitary sewage.

NATURAL OUTLET – Any outlet into a watercourse, pond, ditch, lake or other body of surface or ground water.

PERSON – Any individual, firm, company, association, society, corporation or group.

pH – The logarithm of the reciprocal of the weight of hydrogen ions in grams per liter of solution.

PROPERLY SHREDDED GARBAGE – The wastes from the preparation, cooking and dispensing of food that have been shredded to such a degree that all particles will be carried freely under the flow conditions normally prevailing in public sewers, with no particle greater than one-half (1/2) inch (one and twenty-seven hundredths (1.27 centimeters) in any dimension.

PUBLIC SEWER – A sewer in which all owners of abutting properties have equal rights, and is controlled by public authority.

SANITARY SEWER – A sewer which carries sewerage and to which storm, surface and ground waters are not intentionally admitted.

SEWAGE – A combination of the water carried wastes from residences, business buildings, institutions and industrial establishments together with such ground, surface and storm waters as may be present.

SEWAGE TREATMENT PLANT – Any arrangement of devices and structures used for treating sewage.

SEWAGE WORKS – All facilities for collecting, pumping, treating and disposing of sewage.

SEWER – A pipe or conduit for carrying sewage.

SLUG – Any discharge of water, sewage or industrial waste which in concentration of any given constituent or in quantity of flow exceeds for any period of duration longer than fifteen (15) minutes, more than five (5) times the average twenty-four hour concentration or flows during normal operation.

STORM DRAIN – (sometimes termed “storm sewer”) a sewer which carries storm and surface waters and drainage, but excludes sewage and industrial wastes, other than unpolluted cooling water.

SUPERINTENDENT – The Superintendent of Sewers acting for and on the behalf of the Permanent Sewer Commission of the Town of Hull, his authorized deputy, agent or representative.

SUSPENDED SOLIDS – Solids that either float on the surface of or are in suspension in water, sewage or other liquids, and which are removable by laboratory filtering.

WATERCOURSE – A channel in which a flow of water occurs, either continuously or intermittently.

B. “Shall” is mandatory; “may” is permissive.

§149-2. Permit required for connection; notice of changes in discharge.

- A. No unauthorized person shall uncover, make any connections with or opening into, use, alter or disturb any public sewer or appurtenance without first obtaining a written permit from the Superintendent.
- B. Any person proposing a new discharge into the system or a substantial change in the volume or character of pollutants that are being discharged into the system shall notify the Superintendent at least forty-five (45) days prior to the proposed change or connection.

§149-3. Building sewer permit classes; applications and fees.

- A. There shall be two (2) classes of building sewer permits: one (1) for residential and commercial service, and one (1) for service to establishments producing industrial wastes.

- B. In either case, the owner or his agent shall make application on a special form furnished by the town. The permit application shall be supplemented by any plans, specifications or other information considered pertinent in the judgment of the Superintendent. A permit and inspection fee of twenty-five dollars (\$25.) for a residential or commercial building sewer permit and fifty dollars (\$50.) for an industrial building sewer permit shall be paid to the town at the time the application is filed.

§149-4. Responsibility of owner.

All costs and expense incident to the installation and connections of the building sewer shall be borne by the owner. The owner shall indemnify the town from any loss or damage that may directly or indirectly be occasioned by the installation of the building sewer.

§149-5. Separate building sewers required; exception.

A separate and independent building sewer shall be provided for every building, except where one building stands at the rear of another on an interior lot and no private sewer is available or can be constructed to the rear building through an adjoining alley, court, yard or driveway, the building sewer from the front building may be extended to the rear building and the whole considered as one (1) building sewer.

§149-6. Use of old building sewers.

Old building sewers may be used in connection with new buildings only when they are found, on examination and test by the Superintendent, to meet all requirements of these rules and regulations.

§149-7. Conformance required.

- A. The size, slope, alignment, materials of construction of a building sewer and the methods to be used in excavating, placing of the pipe, jointing testing and backfilling the trench, shall all conform to the requirements of the Building and Plumbing Code or other applicable rules and regulations of the town. In the absence of code provisions or in amplification thereof, the materials and procedures set forth in appropriate specifications of the American Society for Testing and Materials and the Water Pollution Control Federation Manual of Practice No. 9 shall apply.
- B. The connection of the building sewer into the public sewer shall conform to the requirements of the Building and Plumbing Code or other applicable rules and regulations of the town or the procedures set forth in appropriate specifications of the American Society for Testing and Materials and the Water Pollution Control Federation Manual of Practice No. 9. All such connections shall

be made gastight and watertight. Any deviation from the prescribed procedures and materials must be approved by the Superintendent before installation.

§149-8. Underground connections.

Whenever possible, the building sewer shall be brought to the building at an elevation below the basement floor. In all buildings in which any building drain is too low to permit gravity flow to the public sewer, sanitary sewage carried by such building drain shall be lifted by an approved means and discharged to the building sewer.

§149-9. Prohibited connections.

No person shall make connection of roof downspouts, exterior foundation drains, areaway drains or other sources of surface runoff or groundwater to a building sewer or building drain which in turn is connected directly or indirectly to a public sanitary sewer.

§149-10. Notice to inspect and connect.

The applicant for the building sewer permit shall notify the Superintendent when the building sewer is ready for inspection and connection to the public sewer. The connection shall be made under the supervision of the Superintendent or his representative.

§149-11. Guarding of excavations.

All excavations for building sewer installation shall be adequately guarded with barricades and lights so as to protect the public from hazard. Streets, sidewalks, parkways and other public property disturbed in the course of the work shall be restored in a manner satisfactory to the Town Highway Department.

§149-12. Time limit for connection. (Added 5-12-80 ATM. Art. 20)

After being so notified by the Commission, the owner of a house, building or property used for human occupancy, employment, recreation or other purposes shall be allowed two (2) years to connect to the public sewer line.

§149-13. Licensing of persons making connections. (Added 5-12-80 ATM. Art. 21)

The Commission shall license competent persons to make connections to the town sewer system. No connection shall be made unless the contractor and/or individual has received such a license.

§149-14. Connections required. (Added 4-12-82 STM. Art. 14)

Any property owner whose property is accessible to the town sewerage system shall connect said property to the same in accordance with the Sewer Use Regulations.

§149-15. Authority of Permanent Sewer Commission. (Added 4-12-82 STM, Art. 12)

The Permanent Sewer Commission, through its agent(s) or by itself, may require any property owner whose property is accessible to the town sewerage system to be connected to the same within a reasonable amount of time.

§149-16. Prohibited Discharge to Sanitary Sewer.

Preamble: Whereas the unauthorized discharge of water into the sanitary sewer system of the town can result in the introduction into said system of harmful liquids and also results in an overcharging of the system which may lead to damage to the system, all of which may unnecessarily increase the cost of the operation, it is declared that the public health and safety warrant this bylaw regulating same.

- A. No person (which shall also mean any entity or corporation) shall discharge or cause or permit to be discharged any stormwater, surface water, groundwater, roof runoff, subsurface drainage, uncontaminated cooling water or unpolluted industrial process waters or the like to any sanitary sewer by any subsurface drainage, downspout, eave trough, rainspout, yard drain, sump pump, foundation drain, yard fountain, pond, swimming pool, cistern overflow or air conditioning unit or system or similar device or means.
- B.
 - 1. Inspections. All inspections provided for in this section must be at times that are reasonably convenient for ordinary citizens. Town staff may apply to the District Court for an appropriate administrative search warrant if a property owner refuses to allow an inspection of the owner's property.
 - 2. Regular inspections. Within 30 days after written notice from the town, every person owning improved real estate that discharges into the town's sanitary sewer system must allow the town or a designated town representative to inspect the buildings to determine whether there is a prohibited discharge into the sanitary sewer system. In lieu of having the town inspect the property, a person may furnish an inspection report in a form acceptable to the town from a licensed plumber approved by the town.
 - 3. Re-inspections. A property that is found to be not in compliance with this section is also subject to reinspections to confirm that the property is subsequently brought into compliance. Thereafter, the property is subject to

reinspections on an annual basis or when deemed necessary to confirm continued compliance. Properties that are in compliance may also be subject to reinspections to confirm continued compliance.

4. Inspections for building, health, fire or other permits or code compliance. If a town inspector is on property for the purpose of inspecting for compliance with a permit or for compliance with the law, the town inspector has the authority to also inspect the property for compliance with this section.
 5. Inspection for property being sold or conveyed. Prior to the sale, transfer or conveyance of the ownership of a building serviced by a sanitary sewer, the owner, buyer or other appropriate party shall request an inspection and shall file prior to the sale, transfer or conveyance with the Permanent Sewer Commission a certificate of compliance. Changing ownership without such a certificate is a violation of this section. In order not to delay or prevent a pending sale of a property affected by this section, a buyer, other transferee or other appropriate party may file with the Sewer Department evidence of a contract or accepted bid for work which, when completed, will bring the property into compliance with the provisions of this law within the time limits set forth by the Sewer Department, along with evidence that adequate funds have been or will be escrowed to complete said work, and a stipulation agreeing to bring the property into compliance with the provisions of this section. Failure by the buyer, transferee or other appropriate party to so bring the property into compliance shall constitute a violation of this bylaw and shall be subject to the penalties and remedies set forth herein.
- C. Corrections. The owner of a property found to be in violation of this section must make the necessary corrections to comply with this section within the time specified in the written notification from the town.
- D. Temporary waiver. The Chief Facility Manager (or designee) may allow or require a temporary waiver from the provisions of this section where a strict enforcement would cause a threat of damage to other property. A written request for a temporary waiver must be first submitted to the Chief Facility Manager specifying the reasons for the request. If a waiver is required or granted, the property owner must pay an additional fee for sanitary sewer services based on the number of gallons discharged into the sanitary sewer system as estimated by the Chief Facility Manager. The Chief Facility Manager may terminate the waiver upon a failure to comply with any conditions imposed in the temporary waiver or may take appropriate legal action to enforce those conditions. The Chief Facility Manager must give five days advance written notice of the termination to the property owner with the reasons for the action. After expiration of termination of a temporary waiver, the property owner must comply with the provisions of the section.

- E. Violations. Any person, entity or corporation violating the provisions of this section shall be liable to a fine of not more than _____ for each violation. Each day on which any violation or offense exists shall constitute a separate violation or offense. Violations may also be processed under the non-criminal disposition procedure pursuant to Chapter 1 of the Code/Bylaws of the Town.
- F. No warranty. A certificate of compliance or inspection done by the town indicates that so far as can be reasonably determined by a visual inspection of the premises and review of town records, the premises meet the requirements of this article. Neither the town nor its inspectors assume any liability in the inspection or issuance of a certificate of compliance or inspections, and the issuance of a certificate of compliance or inspections does not guarantee or warrant the conditions of the premises inspected.

Nothing contained herein shall be construed to be a specific assurance of safety or assistance.

- G. Remedies. The remedies provided in this section are cumulative and do not limit the right of the town to pursue any available legal remedy.

§149-17. Discharge of stormwater and drainage.

Stormwater and all other unpolluted drainage shall be discharged to such sewers as are specifically designated as combined sewers or storm sewers or to a natural outlet approved by the Superintendent. Industrial cooling water or unpolluted process waters may be discharged, on approval of the Superintendent, to a storm sewer, combined sewer or natural outlet.

§149-18. Prohibited discharge to any public sewer.

No person shall discharge or cause to be discharged any of the following described waters or wastes to any public sewers:

- A. Any gasoline, benzene, naphtha, fuel oil or other flammable or explosive liquid, solid or gas.
- B. Any waters or wastes containing toxic or poisonous solids, liquids or gases in sufficient quantity, either singly or by interaction with other wastes, to injure or interfere with any sewage treatment process, constitute a hazard to humans or animals, create a public nuisance or create any hazard in the receiving waters of the sewage treatment plant.
- C. Any waters or wastes having a pH lower than five point five (5.5) or having any other corrosive property capable of causing damage or hazard to structures, equipment and personnel of the sewage works.

- D. Solid or viscous substances in quantities or of such size capable of causing obstruction to the flow in sewers or other interference with the proper operation of the sewage works such as, but not limited to, ash, ashes, cinders, sand, mud, straw, shavings, metal, glass, rags, feathers, tar, plastics, wood, unground garbage, whole blood, paunch manure, hair and fleshings, entrails and paper dishes, cups, milk containers, etc. either whole or ground by garbage grinders.

§149-19. Restricted discharges.

- A. No person shall discharge or cause to be discharged the following described substances, materials, waters or wastes if it appears likely in the opinion of the Superintendent that such wastes can harm either the sewers, sewage treatment process or equipment, have an adverse effect on the receiving stream or can otherwise endanger life, limb, public property or constitute a nuisance. In forming his opinion as to the acceptability of these wastes, the Superintendent will give consideration to such factors as the quantities of subject wastes in relation to flows and velocities in the sewers, materials of construction of the sewers, nature of the sewage treatment process, capacity of the sewage treatment plant, degree of treatability of wastes in the sewage treatment plant and other pertinent factors. The substances prohibited are:
1. Any liquid or vapor having a temperature higher than one hundred fifty degrees Fahrenheit (150° F) {sixty-five degrees Celsius (65°C)}.
 2. Any water or waste containing fats, wax, grease or oils, whether emulsified or not, in excess of one hundred (100) milligrams per liter or containing substances which may solidify or become viscous at temperatures between thirty-two degrees and one hundred fifty degrees Fahrenheit (32° and 150°F.) {zero degrees and sixty-five degrees Celsius (0° and 65° C.)}.
 3. Any garbage that has not been properly shredded. The installation and operation of any garbage grinder equipped with a motor of three-fourths ($\frac{3}{4}$) horsepower {seventy-six hundredths (0.76) hp metric} or greater shall be subject to the review and approval of the Superintendent.
 4. Any water or wastes containing strong acid iron pickling wastes or concentrated plating solutions whether neutralized or not.
 5. Any waters or wastes containing iron, chromium, copper, zinc and similar objectionable or toxic substances; or wastes exerting an excessive chlorine requirement, to such degree that any such material received in the composite

sewage at the sewage treatment works exceeds the limits established by the Superintendent for such materials.

6. Any waters or wastes containing phenols or other taste or odor producing substances, in such concentrations exceeding limits which may be established by the Superintendent as necessary, after treatment of the composite sewage to meet the requirements of the state, federal or other public agencies or jurisdiction for such discharge to the receiving waters.
7. Any radioactive wastes or isotopes of such half-life or concentration as may exceed limits established by the Superintendent in compliance with applicable state or federal regulations.
8. Any waters or wastes having a pH in excess of nine point five (9.5).
9. Materials which exert or cause:
 - a. Unusual concentrations of inert suspended solids, such as, but not limited to, fuller's earth, lime slurries and lime residues, or of dissolved solids such as, but not limited to, sodium chloride and sodium sulfate.
 - b. Excessive discoloration such as, but not limited to, dye wastes and vegetable tanning solutions.
 - c. Unusual BOD, chemical oxygen demand or chlorine requirements in such quantities as to constitute a significant load on the sewage treatment works.
 - d. Unusual volume of flow or concentration of wastes constituting slugs as defined herein.
10. Waters or wastes containing substances which are not amenable to treatment or reduction by the sewage treatment process employed, or are amenable to treatment only to such degree that the sewage treatment plant effluent cannot meet the requirements of other agencies having jurisdiction over discharge to the receiving waters.

B. Authority of Superintendent.

1. If any waters or wastes are discharged or are proposed to be discharged to the public sewers, which waters contain the substances or possess the characteristics enumerated in Subsection A of this section, and which, in the judgment of the Superintendent, may have a deleterious effect upon the sewage works, processes, equipment or receiving waters or which otherwise create a hazard to life or constitute a public nuisance, the Superintendent may:
 - a. Reject the wastes;
 - b. Require pretreatment to an acceptable condition for discharge to the public sewers;

- c. Require control over the quantities and rates of discharge; and/or
 - d. Require payment to cover the added cost of handling and treating the wastes not covered by existing taxes or sewer charges under the provisions of § 149-24 of this Article.
- 2. If the Superintendent permits the pretreatment or equalization of waste flows, the design and installation of the plants and equipment shall be subject to the review and approval of the Superintendent, and subject to the requirements of all applicable codes, ordinances and laws.

§149-20. Interceptors.

Grease, oil and sand interceptors shall be provided when, in the opinion of the Superintendent, they are necessary for the proper handling of liquid wastes containing grease in excessive amounts or any flammable wastes, sand or other harmful ingredients, except that such interceptors shall not be required for private living quarters or dwelling units. All interceptors shall be of a type and capacity approved by the Superintendent and shall be located as to be readily and easily accessible for cleaning and inspection.

§149-21. Maintenance of facilities by owner.

Where preliminary treatment or flow-equalizing facilities are provided for any waters or wastes, they shall be maintained continuously in satisfactory and effective operation by the owner at this expense.

§149-22. Control manholes.

When required by the Superintendent, the owner of any property serviced by a building sewer carrying industrial wastes shall install a suitable control manhole, together with such necessary meters and other appurtenances in the building sewer to facilitate observation, sampling and measurement of the wastes. Such manhole, when required, shall be accessibly and safely located and shall be constructed in accordance with plans approved by the Superintendent. The manhole shall be installed by the owner at his expense, and, shall be maintained by him so as to be safe and accessible at all times.

§149-23. Measurements, test and analyses.

- A. All measurements, tests and analyses of the characteristics of waters and wastes to which reference is made in these rules and regulations shall be determined in accordance with the latest edition of Standard Methods for the Examination of Water and Wastewater, published by the American Public Health Association, and shall be determined at the control manhole

provided or upon suitable samples taken at said control manhole. In the event that no special manhole has been required, the control manhole shall be considered to be the nearest downstream manhole in the public sewer to the point at which the building sewer is connected. Sampling shall be carried out by customarily accepted methods to reflect the effect of constituents upon the sewage works and to determine the existence of hazards to life, limb and property. The particular analysis involved will determine whether a twenty-four hour composite of all outfalls of a premise is appropriate or whether a grab sample or samples should be taken. Normally, but not always, BOD and suspended solids analyses are obtained from twenty-four hour composites of all outfalls whereas pH's are determined from periodic grab samples.

- B. All industries discharging into a public sewer shall perform such monitoring of their discharges as the Superintendent and/or other duly authorized employees of the town may reasonably require, including installation, use and maintenance of monitoring equipment, keeping records and reporting the results of such monitoring to the Superintendent. Such records shall be made available upon request by the Superintendent to other agencies having jurisdiction over discharges to the receiving waters.

§149-24. Special agreements.

No statement contained in this Article shall be construed as preventing any special agreement or arrangement between the town and any industrial concern whereby an industrial waste of unusual strength or character may be accepted by the town for treatment, subject to payment therefore, by the industrial concern.

§149-25. Damage to system.

No unauthorized person shall maliciously, willfully or negligently break, damage, destroy, uncover, deface, or tamper with any structure, appurtenance or equipment which is a part of the sewage works. Any person violating this provision shall be subject to immediate arrest under charge of disorderly conduct and/or damage to property of the Town of Hull.

§149-26. Powers and authority of inspectors.

- A. The Superintendent and other duly authorized employees of the town bearing proper credentials and identification shall be permitted to enter all properties for the purposes of inspection, observation, measurement, sampling and testing in accordance with the provisions of these rules and

regulations. The Superintendent or his representative shall have no authority to inquire into any processes including metallurgical, chemical, oil, refining, ceramic, paper or other industries beyond that point having a direct bearing on the kind and source of discharge to the sewers or waterways or facilities for wastes treatment.

- B. While performing the necessary work on private properties referred to in Subsection A above, the Superintendent or duly authorized employees of the town shall observe all safety rules applicable to the premises established by the occupant or owner, thereof, and the occupant or owner shall be held harmless for injury or death to the town employees and the town shall indemnify the occupant or owner against loss or damage to its property by the town employees and against liability claims and demands for personal injury or property damage asserted against the occupant or owner and growing out of the gauging and sampling operation, except as such may be caused by negligence or failure of the occupant or owner to maintain safe conditions as required in § 149-22.
- C. The Superintendent and other duly authorized employees of the town bearing proper credentials and identification shall be permitted to enter all private properties through which the town holds a duly negotiated easement for the purposes of, but not limited to, inspection, observation, measurement, sampling, repair and maintenance of any portion of the sewage works lying within said easement. All entry and subsequent work, if any, on said easement, shall be done in full accordance with the terms of the duly negotiated easement pertaining to the private property involved.

§149-27. User charge system

The Commission shall establish sewer use charges to recover the costs associated with the operation and maintenance of the sewerage system.

§149-28. Violations and penalties

- A. Any person found to be violating any provision of these rules and regulations except § 149-25, shall be served by the Commission with written notice stating the nature of the violation and providing a reasonable time limit for the satisfactory correction thereof. The offender shall, within the period of time stated in such notice, permanently cease all violations.
- B. Any person who shall continue any violation beyond the time limit provided for in Subsection A of this section shall be guilty of a misdemeanor, and, on conviction thereof, shall be fined in the amount not

exceeding _____ for each violation. Each day in which any such violations shall continue shall be deemed a separate offense.

- C. Any person violating any of the provisions of these rules and regulations shall become liable to the town for any expense, loss or damage occasioned the town, by reason of such violation.

§149-29. Exemptions [Added 11-15-84 STM, Art. 7]

The town shall exempt low-income persons seventy (70) years of age or older from tying into the town's sewer system.

ARTICLE II

Connections to Building Sewer

[Adopted 4-8-85, ATM, Art. 26²]

§149-30. Definitions.

As used in this Article, the following terms shall have the meanings indicated:

HABITABLE STRUCTURE – Includes any building or edifice used for habitation or employment, amusement purposes and other facilities requiring a portable water supply for sanitary or culinary purposes.

§149-31. Connection required.

- A. All habitable structures having access to sewers of the Town of Hull shall connect to such sewer.
- B. All habitable structures constructed after the effective date of this Article and having access to sewers of the Town of Hull shall connect to such sewer before any use or occupancy is made thereof.

² Editor's Note: This bylaw was also designated as Art. XXXI of the Town Bylaws

§149-32. Exemptions.

Structures by reason of grade, elevation or other just cause, which cannot be drained into the sewer system of the Town of Hull as determined by the Permanent Sewer Commission, are exempt from this Article until such impediment is alleviated.

§149-33. Violations and penalties.

The penalties for violations of this Article shall be as follows:

- A. Any person found to be violating this Article shall be served by the Commission with written notice stating the nature of the violation and providing a reasonable time limit for the satisfactory correction thereof. The offender shall, within the period of time stated in such notice, permanently cease all violations.
- B. Any person who shall continue any violations shall be fined in the amount not exceeding _____ () for each violation. Each day in which any such violation shall continue shall be deemed a separate offense.
- C. Any person violating any of the provisions of these rules and regulations shall become liable to the town for any expense, loss or damage occasioned the town, by reason of such violation.

§149-34. Additional remedies.

The provisions of this Article may be enforced by civil action without limiting the prosecution of any violations hereof.

§149-35. Enforcement.

Nothing contained herein shall prevent or interfere with the enforcement of any other proceeding, rules, regulation, order or law concerning sewer connections.

ARTICLE III

Additional Charges

[Adopted 1-27-86 STM, Art. 16³ and 10-26-87 STM, Art. 214]

§149-36 Interest.

Any sewer user charge not paid within the required time period shall be subject to an interest charge at the same rate as permitted for late tax payments, until paid. The provision shall not affect or limit any collection methods or abatement procedure.

§149-37 Demand charge.

The Treasure/Collector or any other board, department, officer or official may, to offset the additional costs incurred, add to delinquent sewer user bills or demands for payment, being sent to any person or entity who has not paid said bill within the required time period after said bill was originally issued, an additional billing charge not to exceed the maximum demand charge allowed under MGL C. 60, § 16, as the same may be amended from time to time. Nothing contained herein shall limit any legal recourse available to said Treasurer/Collector, board, department, officer or official.

ARTICLE IV

Sewer Rehabilitation Fund

[Adopted 10-26-87 STM, Art. 32.5]

§149-38. Preamble.

Whereas the increased development in the Town of Hull is creating greater demands on the municipal sewerage system due to a greater number of properties connecting into the system than the different parts of the system will be able to handle and resulting in the need to perform sewer improvements, rehabilitation work, replacement work, updating work and repairs, there is hereby established a Sewerage Rehabilitation Fund.

§149-39. Creation; purpose.

There shall be a sewerage rehabilitation fund, the purpose of which is to help offset the costs and expenses associated with the increased demands on the sewer systems and facilities and to provide funds for the Permanent Sewer Commission for the costs of engineering, testing, construction and rehabilitation of sewerage pipes, lines, facilities, plant and pump stations located within the town and to provide funds to do all things necessary to correct, remedy, repair, regulate, prevent and prohibit all forms of infiltration or inflow from groundwater and other sources into pipes, lines, facilities and systems and to take such actions necessary to properly maintain and operate the sewerage system, plant and facilities in the town.

§149-40. Payments; exceptions.

[Revised at ATM May 1,2000]

[Revised at ATM May 13-15, 2002]

Payments/contributions to said account shall be made by applicants for or holders of building permits for the construction, erection, improvement, reuse or rehabilitation of land or the buildings thereon for business, industrial, commercial, multifamily and residential uses or mixtures thereof which are connected or need to be connected to the sewer system of the town and who need a sewer extension permit.

§149-41. Equal dwelling unit system; charge per unit.

- A. The amount of said payment/contribution shall be based on an equal dwelling unit (EDU) or percentage thereof, EDU being a bedroom in a residential dwelling. Percentages are computed using standard flow projections listed in Section 7.15 of Massachusetts Sewer System and Connection 314 CMR 700. Where Section 7.15 of the Massachusetts Sewer System and Connection, 314 CMR 700 does not provide flow estimation projections for the intended use, the Chief Facility Manager shall determine the estimated flow using the best practical methods available.
- B. The current charge per EDU is five hundred dollars (\$500.00). Excluded however, shall be existing single family residences for the purpose of expansions and or additions which do not alter the structures status and or use as a single family residence.

§149-42. When payment due.

Payments/contributions made hereunder shall be made prior to issuance of a sewer extension or sewer connection permit or if said permit has been issued, prior to the Permanent Sewer Commission signing off on the occupancy certificate.

§149-43. Rules and regulations.

The Permanent Sewer Commission may make and issue rules and regulations concerning the implementation of this Article.

APPENDIX F: PRIVATE LATERAL BACKUP GUIDANCE



Town of Hull

www.town.hull.ma.us



PERMANENT SEWER COMMISSION
1111 NANTASKET AVENUE
HULL, MASSACHUSETTS 02045

Tel: (781) 925-1207
Fax: (781) 925-3771
Email: sewer@town.hull.ma.us

Date

Name

Address

City, State, Zip

RE: Address reimbursement notification

Dear Owner:

I have reviewed the circumstances surrounding the sewer back up at your home on Date and have determined that the issue was in the street and therefore the responsibility of the Sewer Department.

I have reviewed the costs incurred by you as a result of this incident and have determined that the costs to release the blockage are bearable by the Sewer Department. As such the Sewer Department will reimburse you the cost of the invoice from Contractor for \$XXX.XX.

Sincerely,

Jim Dow
Chief Facility Manager

APPENDIX G: FOG OUTREACH AND GUIDANCE

GREASE TRAP POLICY

- 1) All new and renovated food establishments will provide outside grease traps properly designed and approved.
- 2) All outside grease traps will not receive any sanitary sewage.
- 3) All kitchen drainage including floor drains and garbage disposals will be directed through a grease trap to the sewer.
- 4) All plans for outside grease traps will be subject to approval by the Permanent Sewer Commission, the Board of Health and the Plumbing Inspector.
- 5) All existing restaurants will be required by the Board of Health to provide grease traps approved by the Plumbing Inspector and the Permanent Sewer Commission within 1 year of acceptance of this policy by the Board of Health, the Permanent Sewer Commission and the Building Commissioner for the Plumbing Inspector.

HULL BOARD OF HEALTH

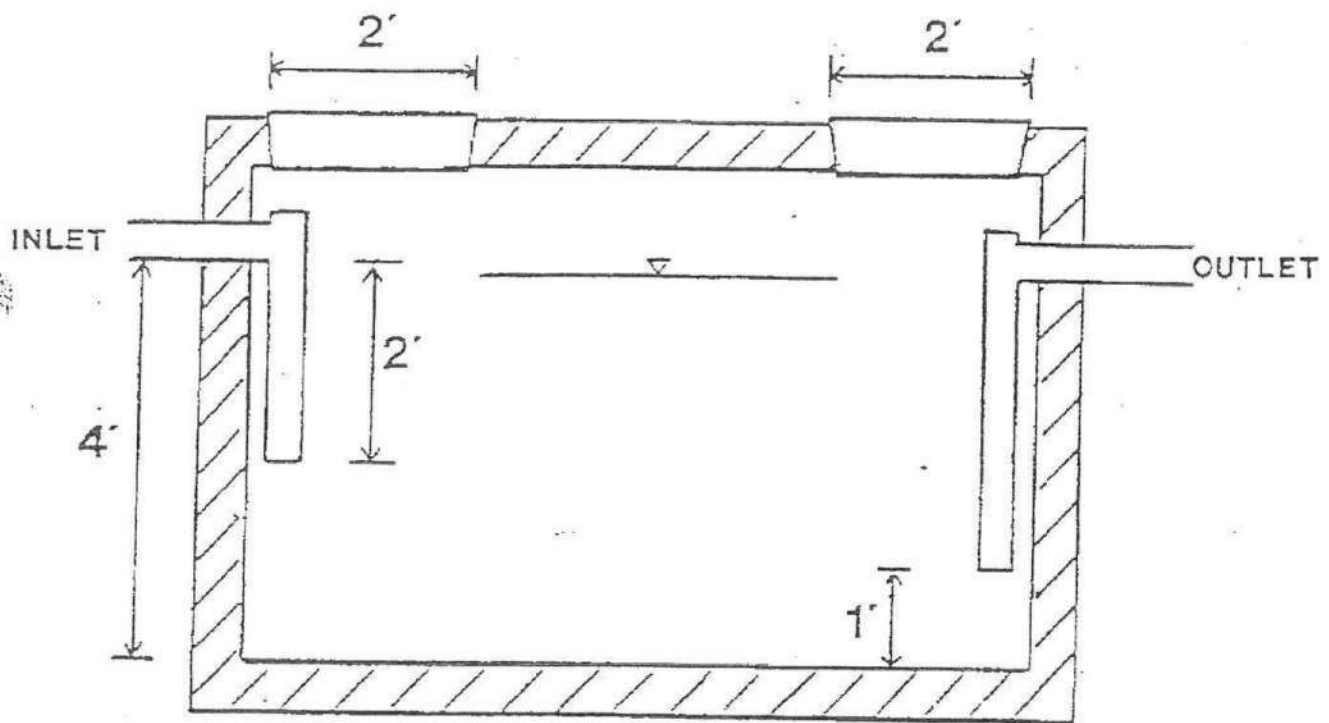
Donald A. Gillis, Chairman
Marilyn A. Lewis
Natalie J. McKeon
Approved 4/27/87

Legal Ad: Hull Nantasket Times
Hull Newsweekly
South Shore Chronicle

TITLE 5

GREASE TRAP

Minimum Criteria



Minimum Capacity = 1,000 gal.

Minimum Detention Time = 24 hrs.

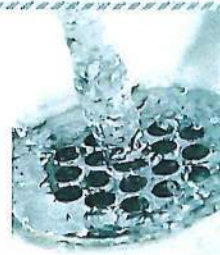
For A 1500 gal tank

Inlet TEE to go half way depth of tank
Outlet TEE Not more than 1' Above bottom
of tank.



Down the Drain

An Informational Newsletter from the
Hull Sewer Department
1111 Nantasket Ave. Hull, MA 02045
(781) 925 - 1207



Issue 2, July 2013

Jim Dow, Chief Facility Manager
Hull Wastewater Treatment Facility

Sewer Odors

With the summer heat comes the possibility of increased odors generated in the municipal sewer system. Below is a couple of things you should know and how to react to them.

Please note that anytime you have a sewer issue, whether it is a back-up in your house or an odor caused by the sewer, you should contact this office prior to hiring an independent contractor. Our crew will verify that the sewer system in the street is operating properly and try to advise you of your next course of action to correct the problem.

- Normal business hours (Monday through Friday 8am – 3:30pm) at (781) 925-1207
- After normal business hours, you can call our contract operator at (781) 925-0906

(If the answering machine picks up, please leave your contact information, there will be additional instructions provided on their message).

What Is the Odor I Smell Coming From My Sewer or Around The Treatment Plant

The most common odors associated with sewers are similar to a rotten egg type smell. This odor is caused by the presence of Hydrogen Sulfide (H_2S) in the sewer lines. Hydrogen Sulfide is a colorless gas that is heavier than air and often results from the bacterial breakdown of organic matter in the absence of oxygen; this process is commonly known as anaerobic digestion. Although the smell of hydrogen sulfide is very offensive and detectable to the human nose at very low doses, often below 1 part per million (ppm), it is very rarely dangerous in the open air where most people will smell it. The presence of hydrogen sulfide must be very concentrated to become dangerous to breath. OSHA has established a permissible exposure limit (PEL) of 10 ppm.

What Do I Do If I Detect An Odor Coming From My Sewer or From Around Town

If you detect an odor coming from the drains inside of your house, it may be a plumbing or venting issue. As long as your sinks and toilets are flowing properly and not backing up, you may first try to run water into them, the plumbing traps may be dry and allowing odors back into your house that way. If the odors persist, you may want to contact a plumber for assistance.

If you smell stronger than normal odors around the outside of your house or at the Wastewater Treatment Plant, you can call our office during normal business hours, an answering machine is available for after-hours calls.

Reporting of odors is encouraged as it will provide us with data to pursue possible causes and cures for these issues.

An aerial view of the Hull Wastewater Treatment Plant



FREQUENTLY ASKED QUESTIONS

How much of the town is connected to the municipal sewer system?

Almost every resident in town is connected to the sewer system; most are connected using gravity flow while many are connected using low-pressure grinder pumps to eject the wastewater into the sewer system.

Will a power outage affect my sewer service?

The only sewer-use customers that will be affected by a power outage will be those that utilize a low-pressure grinder pump to discharge their wastewater into the municipal sewer system. There is no immediate risk of having a back-up if you lose power to your grinder pump because these units have some storage capacity within the chambers. You should however limit the water usage in your house until power is restored.

As a homeowner, what is my role if I experience a sewage overflow or back-up?

The property owner is responsible for the sanitary service which connects your home or building to the public sewer system, the Town assumes responsibility at the street line. The sanitary service on your property (also called a lateral) is the pipe which extends from inside the building to the sewer main in the street. A lateral in poor condition can result in slow drains, blockages, and stoppages of the flow of sewage from your property to the sewer main. This can cause backups into your basement, leading to property damage and potential health concerns. Be careful what you flush to keep your lateral in proper working order. If you do have a blockage, call us first and we will ensure that the street is flowing properly. If the street is flowing, you will then be advised to contact a plumber.

Is my service affected by what I rinse down the sink or flush down the toilet?

Yes! Materials such as sanitary napkins, bandages, coffee grounds, eggshells, kitty litter, paper towels, diapers or any items that will not totally dissolve should be disposed of in your trash. Dispose of hazardous materials such as motor oil, transmission fluid, anti-freeze, paint, turpentine and caustic household cleaners at proper hazardous waste collection sites. Limiting what you put down your drain will help to keep your sanitary service flowing freely and working properly.

Is it bad to wash cooking grease down my drain?

YES!

You should never dispose of cooking or other types of grease, (known as Fats, Oil & Grease or FOG) down any sink drain or the toilet inside your home. Dry wipe or scrape pans, pots and plates prior to washing them. Put the wiped/scraped food material into the trash for disposal. As Fat, Oils, and Grease travels through the service lateral and enters the sewer system the FOG will solidify and cause blockages and stoppages that can cause the sewer to back-up into your building or other buildings on the same line.



What do I do if I have non-sewer related flow going into my sewer lateral in the basement?

You are required to correct any illicit connections, such as roof drains, downspouts, driveway drains, foundation or footing drains or sump pumps connected directly to the sanitary sewer system. The storm water collected from these devices must be disconnected from the sanitary sewer and the flow diverted onto your lawn or driveway or be redirected toward the storm drain system.

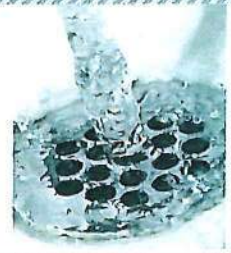
How do you calculate my sewer bill?

Sewer bills are based on water usage. They are calculated using consumption readings provided to us for sewer customers that receive their water from the Aquarion Water Company. For well water customers, a state mandated cost table is used to determine your bill (the owner may install a meter to measure water usage at their own expense). Bills are sent out in February and August each year and each one covers the prior six month period.



Down the Drain

An Informational Newsletter from the
Hull Sewer Department
1111 Nantasket Ave. Hull, MA 02045
(781) 925 – 1207



Issue 3, January 2014

Jim Dow, Chief Facility Manager
Hull Wastewater Treatment Facility

Low-Pressure Grinder Pumps

Many residents in town use low-pressure grinder pumps to discharge the waste from their homes. Some of these are privately owned and some are owned by the Town. Regardless of ownership of these units, proper care and attention are required to make sure that these units function properly and efficiently for as long as possible. If you do have one of these pumps on your property, please insure that nothing other than human waste and toilet paper gets flushed down your toilet. Other items, such as feminine products, floss, "disposable" wipes etc can cause the impellers to jam and render the system inoperable. Once the impeller is jammed, you may not even be aware of a problem until your alarm sounds or possibly begin to experience slow drains or even a back-up in your house. For best results, keep improper materials from entering the system and you should have minimal problems.

Proper vs. Improper Materials to Flush

As with the proper care of grinder pumps listed above, the same precautions should be taken with any type of connection to the municipal sewer system. Cooking grease is a common thing that is rinsed into the sink and can cause problems in a short time frame. Even though your sink water may be warm and the grease slides off the pan, once it gets into a small diameter pipe, it begins to coagulate and before long, it can cause the entire inside diameter of a pipe to seal shut. Please refrain from dumping cooking grease and oil down the drain, dispose of it in a proper manner.

Garbage disposals can also lead to problems because they give people a false sense of security, by grinding up materials before they are discharged. This grinded up material often sits on the bottom of pipes and causes obstructions in sewer laterals and in the street

Sump Pumps

Living in a low-lying area of town often comes with the need to have a sump pump in your basement. Because these pumps often operate automatically with float switches, when the need arises for the pump to come on, most people are not even aware of the location in which these pumps discharge the water. Many people are also unaware that according to Town By-Laws, it is not allowable to have sumps discharge directly into the sewer system. All non-sewer disposed water that enters the sewer system adds to the overall wear and tear on the system and treatment process. Please check your sump pit and follow the route that the discharge piping takes to insure that it dumps the flow into your yard or a pit of some sort. If the pipe leads directly to the sewer line leaving your house, we ask that you have it redirected immediately.

Do You Have A Sewer Blockage or Slow Drains?

If you are experiencing any type of a sewer back-up or even unusually slow drains, please contact this office immediately. Do not call a private plumber first, let us know what is going on and we will dispatch a crew to check the sewer line that runs in front of your house to make sure that the street is flowing properly. If there is a problem in the street, the call to a plumber that you made may cost you money that you didn't need to spend. Once the street is inspected, someone will contact you to tell you the status of their findings and then advise you of what your next steps should be. The Sewer Department number is (781) 925-1207. After hours and weekends, please call the pager at (781) 226-1494

Who Do I Call If The Problem Is Mine?

If you do have a sewer flow problem that is determined to be your responsibility, you can call any licensed plumber that you choose to try to snake your service line and clear your problem. If the plumber is unable to clear your line and you have a more substantial problem that may require an excavation, you will have to hire a contractor licensed to perform this type of work.

Is There A Specific List of Licensed Sewer Contractors?

Yes. Although this list changes frequently, there are currently seven contractors that are licensed through the Hull Sewer Department to perform repair, maintenance and installation of sewer lines within the town. Feel free to contact the Sewer Department office for the most up-to-date list prior to choosing a contractor. The current list consists of:

Aqua Line Utility Contractors

268 Washington Street
East Bridgewater, MA 02333
(508) 690-2009

James Barbuto

1 Dennis Street
Hull, MA 02045
(781) 925-2635

DiVito Construction

664 Nantasket Avenue
Hull, MA 02045
(781) 925-0203

Hub Construction

PO Box 421
Hull, MA 02045
(781) 925-3766

Iaria Brothers

33 Oak Street
Hingham, MA 02043
(781) 749-9468

F. Riley Construction

PO Box 564
Hingham, MA 02043
(781) 749-2577

Sean Farrell Excavation

53 Gilbert Street
Quincy, MA 02169
(617) 472-2020

Are There Any Fees Involved With Doing A Sewer Repair?

Yes, there are different fees based on whatever type of work is required at your property, whether it is to fix a broken pipe, to relocate an existing sewer line or to cap off a line to perform renovations at your property. Please contact our office at (781) 925-1207 for the exact fee for your project.

Who Oversees the Operations of the Sewer Department?

The Sewer Department is under the guidance of the Department of Public Works. The wastewater treatment plant, our seven sewer pump stations as well as all of the sewer pipes and structures in the streets throughout Hull (called the collection system) are operated and maintained by a private company. The current contract is held by United Water which employs several local residents on their workforce to run the system. There are also five citizens that donate much of their free time to make up the Permanent Sewer Commission; they are responsible for setting policy and rates.

The Commission is:

John Struzziery, Chair
Ed Babcock
Lou Collins
Jack Kelly
Rick Matilla



Down the Drain

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(781) 925 – 1207



Issue 6, July 2015

Jim Dow, Chief Facility Manager
Hull Wastewater Treatment Facility

A New Company Under Contract to Operate and Maintain the Sewer System and Treatment Plant

During the Fall of 2014 with the existing contract for O&M services expiring, the Town of Hull sent out a Request For Proposal (RFP) for qualified vendors that could operate and maintain the wastewater treatment plant and the collection system throughout the town. Woodard & Curran, an integrated engineering, science, and operations company was chosen. W&C serves public and private clients locally and nationwide. Hull residents that worked under the former company, Joe Basler and Rick Sutton stayed on with the new company along with the Assistant Plant Manager Kevin Stetson. New to the Hull operations are Plant Manager Aram Varjabedian, Harvey King, John Currier and Frank Cavaleri (the Area Manager).



(left to right: Joe Basler, John Currier, Rick Sutton, Harvey King, Plant Manager Aram Varjabedian, Assistant Plant Manager Kevin Stetson and Area Manager Frank Cavaleri)

Why Has My Sewer Bill Increased?

As almost everyone in town is aware by now, the failure at the treatment plant in February of 2013 was a costly one. All of the electrical controls and components located below the main floor of the plant were affected by the catastrophic flood and had to be repaired or replaced. At the May Town Meeting the voters approved a bond to fund the repairs and we are now paying the principal and interest on that bond.

Another contributing factor in the sewer rate increase was the new 10-year Operations & Maintenance contract.

Longtime Sewer Commissioner Steps Down

After over 8-years of service to the Town as a member of the Permanent Sewer Commission, Jack Kelley has decided that it was time to step aside. Jack's ability to apply his business sense to the issues brought forth before the Commission has been invaluable and his input will be missed. If you see Jack out and about, feel free to thank him for his years of service.

If My Sewer Line Breaks, Can I Dig It Up and Fix It Myself?

No, there are very complex issues involved in repairing a sewer line and there are also strict State and Federal Regulations that must be followed when excavating. If you have a sewer line that needs to be repaired, you must hire a qualified contractor that is licensed through this office and insured to perform this type of work.

Any of them will give you a free estimate to do the work. If you need a copy of this list, please call our office.

What is Fats, Oils and Grease and How Does It Affect Me?

Fats, Oils and Grease (FOG) are byproducts of everyday cooking, usually the mess that is left in your pans after cooking. FOG should be disposed of in trash barrels and not in the sewers. Many people simply rinse this stuff off their plates and pans in the kitchen sink and think that it's gone forever. The reality is that once this FOG gets rinsed down the sink, it starts to solidify and coagulate with other grease already in the sewer line. Once it starts, it doesn't take long until an entire area of pipe is clogged and creating back-ups in people's basements. The clearing of sewer lines and then the sanitary clean-up after a sewerage back-up is very expensive, protect yourself and keep the FOG where it belongs, in the trash. Using an old tin can to pour the grease into until it cools down enough throw into the trash is the best way to dispose of it.



What Do I Do If I Encounter A Sewer Back-up In My House?

There are many causes of residential back-ups some of the most common are due to off-set pipes, root intrusion or debris build-up. The first thing to do if you have a back-up is immediately stop using the household water and contact this office. We will dispatch a crew to investigate. Because the Town assumes responsibility at the street line, our crew will check both the upstream and downstream manholes around your property to ensure that the street is flowing properly. If the street is flowing freely, you will be notified and will have to contact a plumber to further investigate from the inside your house out to the street line. If the problem requires an excavation, a list of licensed contractors can be provided for you from this office. If you experience a back-up, please call (781) 925-1207 during normal business hours. For after hours and weekend emergencies, you can call (781) 925-0906, instructions are available on the machine as to how to contact our on-call person.

A Couple of Hints to Help Prevent Future Sewer Related Headaches

The chances are that you don't know the condition of your sewer line or even ever gave it a thought. Most people don't until they experience a sewer back-up in their basement. If you have older plumbing or just want to protect your house from a potential back-up, you may want to consider hiring someone to conduct a television inspection of your pipe. A small camera is placed inside your clean-out in the basement and hand fed on a cable through the length of the pipe while projecting an image on a video screen. Within minutes you will know the condition of your sewer line. Many plumbing/drain cleaning companies have these cameras. Another helpful hint: install an outside clean-out. If you are having any work done to your sewer pipe, ask them to install an outside clean-out. It's just a basic wye that you install a vertical piece of pipe to up to ground level. This allows you to access your sewer line from the outside for maintenance or emergency reasons. If you experience a back-up and don't have an outside clean-out, you will have to open the one in your basement. An outside clean-out will allow access to your sewer line without creating a mess in your cellar.

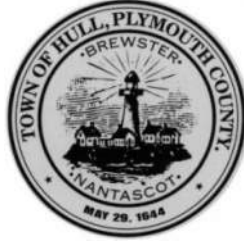
Disposable Wipes

As stated in previous newsletter issues, in sewer bills and in newspaper articles, "disposable" wipes continue to be a major problem in municipal sewer systems everywhere. Even though they are labeled as "disposable" and some even use the term "flushable", we ask that you please dispose of these wipes in your trash barrel after using them and **do not flush them down the toilet**. Most of these wipes do not break down as quickly as they need to in order to keep flowing through the system. Aside from human waste, toilet paper is the only acceptable item that should ever be flushed in order to maintain an efficient sanitary waste line.



Town of Hull Wastewater Treatment Plant

1111 Nantasket Avenue
Hull, MA 02045



Phone: (781) 925-1207

Fax: (781) 925-3771

Date: _____

Time: _____

RE: Service Call

Property Address: _____

This is a courtesy letter to you as the resident/homeowner of a property connected to the Town of Hull municipal sewer system. As you may or may not be aware, the service lateral and all of its components that discharges the household waste from your property to the Town of Hull municipal sewer system belongs to the building owner/homeowner. The Town takes responsibility for the system at the street line.

A service call was performed today in the vicinity your property for inspection or servicing. All of the work that was performed and/or will be performed will take place on the Town of Hull municipal sewer system (i.e. from the street line to the sewer line in the street) and was/will be performed by an authorized representative of the Town of Hull or one of its contracted service providers.

- ☐ _____ The Town's portion of the municipal sewer servicing your property was found to be operating properly and flowing freely. It is recommended that you contact a licensed plumber or licensed sewer contractor to address the blockage or other issue that is causing your interior service lateral or other sewer line problem.
- ☐ _____ The Town's portion of the municipal sewer servicing your property was found to not be operating properly and was cleared and appears now to be operating properly.
- ☐ _____ The Town's portion of the municipal sewer servicing your property was found to not be operating properly and has been scheduled for additional repair and/or maintenance work.

As with all mechanical devices, it is important that the resident/homeowner be vigilant in monitoring the systems servicing their property. Due to the numerous factors beyond our control, the Town cannot and does not provide an explicit and specific assurances of safety or assistance.

If you have any further questions about your service lateral, please contact the Sewer Department office.

Respectfully,

Jim Dow, Chief Facility Manager
Hull Wastewater Treatment Plant

Reason for Today's Service Call

Inspection: _____

Service Call: _____

Comments: _____

Service Provided by: _____

Follow-up Visit Required

YES: _____

NO: _____

Sewer Works



Message from the Director of Wastewater Operations

It's a privilege to serve as the new Director of Wastewater Operations. As some background, my experience includes 42 years as a consulting civil engineer for various public agencies and municipalities in planning, designing, and overseeing construction of sewer systems and civil infrastructure. Many of you may also know that I was chair of the Permanent Sewer Commission for over 35 years and bring that history and experience to this position.

Our wastewater collection and treatment system is over 40 years old and is in need of upgrading and renewal. The Town is

working with EPA and DEP to perform a Fiscal Sustainability Plan (FSP) and Capacity Management Operations and Maintenance (CMDOM) plan to address past practices, improve operations, and provide better tracking of problem areas and needed improvements. More on this in future updates.

This Newsletter is intended to describe information about the wastewater collection and treatment system, what we do, what you can do to improve operations, and overall provide a better understanding of how your sewer charges are being used. We hope you like our new title,

Sewer Works, as we believe it provides the context of the Sewer Commission working for you to improve the water quality and quality of life in Hull.

John Struzziery, Director of



Wastewater Operations

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About Your Sewer Bill

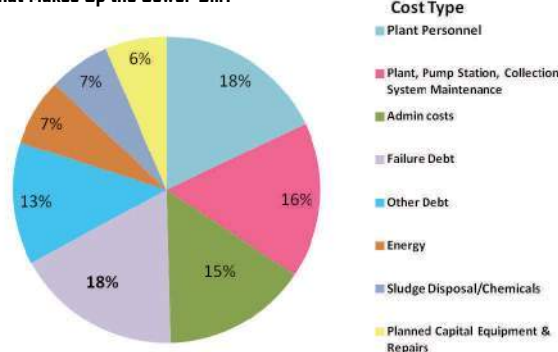
Your sewer bill is based on the amount of water used that must be treated. The Water Usage is the amount of water you used as provided by Aquarion Water Company for the billing period. It is in units of CCF (centum (hundred) cubic feet. One CCF is approximately 750 gallons. Your

usage is based on the meter reading of actual water used as recorded or estimated by Aquarion. For this reason it is important to periodically check for leaks in your water system since every gallon of water also corresponds to a sewer usage charge—see related article "How

to Check for Water Leaks."

The chart below shows the various items that make up the sewer bill. What is not included is the projected capital costs to upgrade the system. More on this as we develop our plan for the future.

What Makes Up the Sewer Bill?



Average Semi-Annual Sewer Bill is
\$480 or \$80 per month.

See next page to make sure you're doing your part to keep costs down

Here are three simple things you can do to save money on your water and sewer bills, and/or prevent problems in your service

Waste Not & How to Check for Water Leaks

Wasting water not only increases your water bill, but also results in a higher sewer bill. Be aware of excess water use in your home—shorter showers, turning water off when hand washing dishes, shaving and brushing teeth, and being aware of water leaks from dripping faucets. All can add to excess water usage and higher sewer bills.

Toilets are typically the largest source of water use in the home. Replacing with a low flush toilet

can reduce water usage by 25% or consider placing a toilet dam such a water-filled plastic bottle with sand or stones for weight in the tank to reduce the volume of water in each flush.

Leaking toilets can be found by doing the following: Lift and remove the top of the tank, place a few drops of non staining food coloring in the toilet tank to give it a good color, let sit for 30 minutes—DO NOT FLUSH. If color then shows in the bowl, it means

you have a leak which typically can be repaired by cleaning or replacing the flush valve or flap-per in the bottom of the tank.

A dripping faucet for example can add over 5,500 gallons per year (7 CCF) to your sewer bill. Leaking faucets and shower-heads are typically caused by worn rubber washers which are easy to replace. Installing low cost aerators on faucets and showerheads can also reduce the amount of water used.



Pour a few drops of food coloring in tank



Wait 15-30 mins, water in bowl should be clear



If you see color in the bowl—you have a leak

No Wipes in the Pipes—the Three Ps

One of our biggest issues we deal with is cleaning wipes, rags, diapers, mop heads and other debris not intended to be in the sewer. This is a problem in all sewer systems and has been increasing as so called “disposable” and “flushable” wipes have become more available and common use. Don’t believe the hype even if the

package says it is flushable. These claims are not backed up, however your sewer or our pumps might back up! It takes hours before they become dispersed as fibers and in that time, they collect and get tangled with other debris, and have been a major source of maintenance when they get clogged in our pumps.

An easy rule to remember is “**No Wipes in the Pipes.**” Help us keep costs down by disposing of these products, and even dental floss, in the trash can. Another way to remember what can be disposed down the toilet is only the “**Three Ps**”—*Paper, Pee, and Poo!*”



Can the Grease



Fats, oils and grease, known as FOG in the wastewater industry, is made up of many items in kitchens and restaurants such as cooking oils, lard, butter, gravy, salad dressing, mayonnaise, and dairy products. When poured down the drain, FOG can solidify and clog pipes and cause sewer backups anywhere on your property or in the sewer system. You are responsible for costs of dealing with repairs, or

even worse backups on your property.

The Sewer Department spends considerable time and money removing FOG from sewer pipes and pumping stations, which impacts our sewer rates.

We ask all users to **Can the Grease** to help keep FOG out of our sewers. When disposing of these items, let the oils and

grease solidify, dry wipe or scrape remaining solids, then dispose of the wiped/scraped material in the **trash can**, not the drain. Restaurants need to do their part by using and maintaining grease traps and holding tanks.

Being more aware of what causes sewer problems will help reduce problems and keep costs lower.



Meet the Sewer Department Staff

We have two full time staff at the Sewer Department office located at the Wastewater Treatment Facility.

Carol O'Connor is the Book-keeper and is responsible for tracking all payments to vendors, maintain the budget and expenditures of the department, and in working with members of Town management to compile the financial impact of decisions in order to develop the sewer billing rate which is presented to the members of the Permanent Sewer Commission for discus-

sion and approval. In addition, Carol performs customer service, administrative, other financial and record keeping duties to support the daily operation of the Sewer Department, Public Works, and the Sewer Commission.

Terri Berardinelli is the Facility Coordinator, responsible for customer service pertaining to sewer billing; responds to inquiries and requests for information to the Sewer Department; maintains records of sewer service connections and grinder pumps; prepares and provides estimated

billing information and sump pump inspections prior to property sales; reviews building permits to determine if the Sewer Department will be impacted by the project; and maintains files pertaining to property owners and contractors.

We also want to thank and acknowledge the work previously done by Jim Dow who served as the Chief Facility Manager. Jim is now serving as the Director of Public Works.



Hull Wastewater Treatment Facility

Meet the Sewer Commissioners

The sewer commissioners have primary responsibility in setting sewer department policies and in setting sewer rates. In addition, they monitor sewer department work activities and work of our contract operator. It is a volunteer position and they generally meet on the third Tuesday of every month in the evening.

Present Commission members are Rick Mattila since 2012, Lou

Collins since 2001, and Ed Babcock 2013.

Rick is retired from Genzyme Corporation as the Director of Environmental Affairs and retired US Army Medical Department. Rick has served on committees related to water quality. Lou is an operator with MWRA on Deer Island and brings the operator perspective and understanding to Commission meetings.

Ed retired from being an operator at the treatment facility where he worked for 15 years and brings his knowledge and that experience to assist in any historical perspective that is needed.

All commissioners are provide thorough review, good thinking and fairness in their responsibilities.

Currently, we only have three members of the Permanent Sewer Commission and are looking to fill the two vacant positions. Anyone who is interested in learning more or in applying, please contact Lori West, Town Clerk, at lwest@town.hull.ma.us

Woodard & Curran-Our Contract Operator

Woodard & Curran (W&C) is responsible for the operations and maintenance of the wastewater treatment facility and sewer collection system, including 7 pumping stations and one stormwater pumping station.

W&C operates over 53 facilities under contract with governmental and private clients. As our contract operator, W&C is responsible for all staffing, treatment compli-

ance, odor control, staffing, maintenance, emergency response, and other assistance to the Sewer Department. W&C Area Manager, Frank Cavaleri has a long history in Hull and served with the first contract operator many years ago, and knows the system well. Frank is supported by Assistant Area Manager, Rob Scott. The daily staff includes Project Manager, Aram Varjabedian; Assistant Project Manager, Bill Boornazian, Lead

Operator, Joe Basler; and Operations & Maintenance Technicians Eric Sutton, Rick Clark; and John Currier. In addition, other support staff, specialists and engineers are available for any special need.

W&C provides staffing at the facility seven days per week all year.

Insert new Photo—fix caption



L to R: Joe Basler, John Currier, Eric Sutton, Harvey Rick Clark, Plant Manager Aram Varjabedian, Assistant Plant Manager Bill Boornazian, and Area Manager Frank Cavaleri

Featured Ongoing Work

Since the start of the new year work continues to provide stabilization and reliability to day to day operations. One big work item has been the change out and replacement of one of the two pumps at our pumping station off George Washington Boulevard. One pump was changed out, another pump removed to get rebuilt and suction piping cleaned from clogs due to rags, grease, and other debris.



Pump being removed to be rebuilt

To complicate the work, one of the valves that isolate the station is broken open and we needed to plug the sewer to divert flow using another surface bypass pump as shown in the photograph. Plans are being made to replace the broken valve. This station serves the south end of town including flows from Cohasset and Hingham.

At the treatment facility, we have many projects underway and/or

planned. Perhaps one of the biggest issues we are facing is the lack of redundancy and backup of much of the equipment. Since most of the equipment and piping is over 40 years old, runs 24 hours per day, and has either already been repaired, rebuilt or replaced, there is considerable wear, corrosion, and loss of efficiency that necessitate assessing every components priority and risk of failure as a means to prioritize what work gets done.

We're also working on implementing our asset management grant that will provide an inventory, risk assessment, criticality, and consequence of failure of all equipment which will help prioritize our planning of future upgrades and replacements.



40 years of corrosion is taking a toll on all of our piping

Many of you may have heard about the American Society of Civil Engineers (ASCE) Report Card of 10.5 Card of our nation's infrastructure. This has been a regular feature of ASCE to raise attention regarding the lack of

funding and poor condition of our underground utilities and surface infrastructure. Ratings have consistently been graded as D- and recently improved to D.

Similarly, we have taken a subjective look at Hull's wastewater infrastructure and show our current **Report Card** on the right. An explanation of the rationale and basis for the ratings is briefly described below the chart. Unfortunately, Hull is not much better than our nation. Over the next number of years we intend to justify needed improvements and upgrades to raise our grade. We will do this responsibly and with purpose as part of our long-term capital improvement program. More about this will follow in later newsletters.

After the plant failure in 2013 we appropriated \$6.9 M of which \$5.1 M has been spent mostly on emergency response actions, getting the plant operational while focusing on electrical, mechanical, and process functionality. The remaining balance of \$1.8M will be used for a capital improvement program, and other upgrades to allow adaptability for pumping and flow control improvements.

Report Card of Hull WW System

Treated Water Quality	B+
Wastewater Treatment Facility	D
Interceptor System	C-
Sewer Collection System	C-
Pumping Stations (7)	C-
Force Mains	C-
Overall Grade	C-

Treated water quality is generally excellent and meets permit condition, however, due to vulnerability of other systems, this grade shows lower.

WW treatment Facility is 40 years old with many systems only working as a single unit without any backup or redundancy.

The Interceptor Sewer is the large pipe essentially running the length of Nantasket Avenue that collects all flow from the pumping stations and side street collector sewers. This is a 30" and 36" diameter concrete pipe that has had one collapse in the past and shows significant deterioration and loss of structural strength in other areas. Some portions have been lined to renew its condition, the remaining areas need to be renewed.

Some parts of the Sewer Collection system date back to the 1850s. Various pipe materials were used in the past and much of the system has significant leakage from groundwater and stormwater. Private service laterals are also a source of this excess water.

The Pumping Stations serve to transport wastewater from lower areas that can't flow to the interceptor by gravity. While each station functions, there is little backup capability and improvements are needed.

Force Mains are pressure pipes from the pumping stations to the interceptor. Like the other pipelines, they are subject to corrosion and deterioration and need to be renewed.

Communications

We expect in time we will have other means of social media to interact with you. We believe it is important to show you more of what we do every day, provide information important to you, and advise of happenings that you may want to know about. Watch for more as we roll this communication out over time.

Look for information in our next newsletter on how our sewer system works and how our treatment system works.

Contact Information

sewer@town.hull.ma.us

Office: 781-925-1207

APPENDIX H: SAMPLE DOFORMS

1. MANHOLE INSPECTION

2. WORK ORDER



Work Order

Hull Wastewater

Work Order Information

Date: 05/31/2017 **Type:** Corrective Maintenance **Status:** Completed
Asset: MH 20143 **Priority:** Normal **Reason:** Corrosion

Description of Issue

Description: MH 20143 broken 26" cover

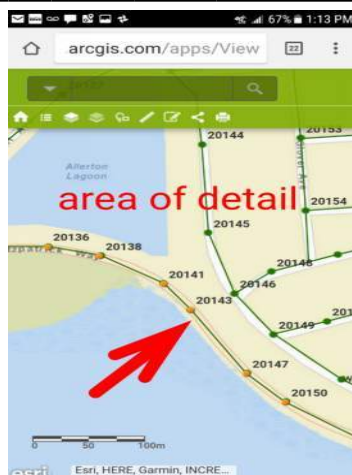
Notes:

Actions Taken

Staff: Eric Sutton

Service: Observed broken MH cover while working with Ted Berry Eric Bill replaced cover

Photos





Hull Wastewater

Work Order Information

Date: 05/08/2017

Type: Inspections

Status: Completed

Manhole ID: MH 20075

Priority: Normal

Reason: Operational

Description of Issue

Description: Manhole Inspection

Notes:

Actions Taken

Staff: John Currier

Service: Flowing freely. Slight rag/debris buildup present on shelf

Photos





Hull Work Order



System

Hull Wastewater

Type *

Corrective Maintenance



Asset *



Description *

Priority *

Normal



Department *



Reason *



Arrival Time *

06/22/2017 11:52:16

Now

Departure Time *

06/22/2017 11:52:16

Now

Action Notes *

Hours *

This question ends the section. Do you wish to repeat?

Images (1)

X

Picture



Capture

Select

Picture Description

This question ends the section. Do you wish to repeat?

Email Work Order

bdouglas@woodardcurran.com
fcavaleri@woodardcurran.com
avarjabedian@woodardcurran.com
wboornazian@woodardcurran.com

Optional message...



Save & Send



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